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About this issue . . .

What evidence can archeologists offer to counter creationist claims? Francis B. Harrold answers that question in this issue's lead article. He shows how actual archeological research by creationists is extremely rare, resulting in their saying little about it in their model. Yet, the evidence from prehistoric archeology puts additional nails in the creationist coffin, especially as it relates to Peking Man. Such archeological data supports the conclusions of paleoanthropologists—not creationists.

What analyses can folklorists bring to bear on the creation-evolution controversy? Wade Tarzia provides an answer in the second article. He analyzes the linguistic tendencies appearing in creationist texts and shows how they more closely resemble folk tradition than science.

Dale F. Beyerstein continues the linguistic analysis from a philosophical perspective, noting how creationist rhetoric misuses language in ways that obscure rather than expose the facts. This provides valuable warnings and useful tools to all who contemplate engaging creationists in debate.

And speaking of debate, in this issue we conclude the Brown-Lippard exchange, allowing our readers to have the final say. It is worthy to note that this particular debate has inspired a greater reader response than any previous dialogue, and we are pleased to print a greater-than-usual number of letters.

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Past Imperfect: Scientific Creationism and Prehistoric Archeology

Francis B. Harrold

This article explores one aspect of "scientific" creationism and suggests that it illustrates an important general point about that enterprise. I began this investigation because, as an archeologist who has also written about creationism (Harrold and Eve, 1987; Eve and Harrold, 1990), I was interested in how the movement's most influential spokespeople—scientific creationist authors—regard my anthropological specialty.

Scientific creationists are anti-evolutionists who, rather than simply rejecting scientific findings out of hand, argue that scientific evidence, when correctly interpreted, really *supports* their beliefs. They blame the alleged dogmatic materialism of mainstream scientists for the failure of said scientists to see this truth.

Most prominent scientific creationist authors are "strict" or "young-earth" creationists. According to their literalistic interpretation of Genesis, the earth and all its life (including humankind) were created in more or less their present form during creation week, variously estimated to have been between six thousand and ten thousand but not more than twenty thousand years ago (since Genesis does not specify the date of creation, there is room for disagreement).

Scientific creationists attack standard interpretations of the geological and fossil records, the theory and practice of radiometric dating (such as radiocarbon dating), and any other findings of science which imply an ancient earth or evolutionary processes. They are particularly concerned with human evolution—the very concept of which they regard as degrading and even satanically inspired—and attempt to show that claimed ancient hominid fossils are really either frauds, apes, or modern people.

As a result, they have little patience with prehistoric archeology, a discipline involving the study of material remains of past cultures which did not produce written records. Since the earliest known archeological sites are over two million years

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old, and since writing was not invented until about five thousand years ago, prehistoric archeology is our main source of information about human behavior for more than 99 percent of the cultural past. Prehistoric archeologists recover and analyze implements of stone and other durable materials, traces of hearths, huts, and other structures, animal bones processed by hunters, and other clues to the behavior and environment of ancient people. Archeologists' work is complementary to but analytically separate from the study by physical anthropologists of the fossil remains of ancient humans (and prehumans). Prehistoric archeology supplies some information which the actual remains of our distant ancestors cannot—not the least because archeological sites are far more plentiful than human fossil finds. The fullest understanding of ancient humans, of course, comes from integrating the results of analyses of both fossils and archeological sites.

Differing Portraits of the Past

Prehistoric archeologists and scientific creationists draw very different pictures of the human past (*see* Figures 1 and 2). Archeologists date the earliest known (and very crude) stone tools from sites in Africa to at least 2.3 million years ago. These artifacts are found in contexts indicating their use to obtain both meat and plant food by small-brained early humans. From the time of these earliest tools, slow and uneven progress in the sophistication of tookmaking and tool use appears in the archeological record.

By one million years ago, humans making more sophisticated tool kits had spread across the tropics from Africa to Asia. Before half a million years ago, they had inhabited much of Europe and Asia, had become fairly successful hunters, and had begun to use fire. Later developments included the appearance of deliberate burial of the dead and early forms of symbolic expression, such as art. Eventually, the species spread to Australia and the New World. By ten thousand years ago, plants and animals were being domesticated in the Near East, and by five thousand years ago, civilization had developed there (both of these latter developments were independently achieved elsewhere—for example, in Mexico and South America). Evidence for these conclusions has been excavated from literally thousands of sites, many of which contain numerous stratigraphic levels representing separate occupations stacked atop one another to a depth of many meters (for good general accounts, *see* Klein, 1989; Wenke, 1984).

The creationist account of the human past is radically different (*see* Figure 2; also Moore, 1983:184–265; Morris, 1974:174–195, 1984:290–426). It begins with creation, usually dated between six thousand and ten thousand years ago. Creationists assert that, since the first humans were fully modern in intelligence and anatomy, such achievements as agriculture and pastoralism, cities, and crafts like metalworking and pottery appeared shortly after creation. They cite Genesis 4:17, for

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The Human Past According to Prehistoric Archeologists

Years Ago	Developments
ca. 5,000	Civilization (Near East): cities, writing, and so forth
ca. 6,600	Metalworking (Europe)
ca. 10,000	Farming and herding (Near East)
ca. 12,000	Pottery (Japan)
ca. 35,000	Earliest art (Europe)
ca. 75,000	Deliberate burial of dead
ca. 500,000	Control of fire
ca. 1,000,000	Dispersal from Africa
ca. 2,300,000	Earliest stone tools

FIGURE 1

Earliest known occurrences of several important developments in the human past. (Sources: Wenke, 1984; Klein, 1989)

The Human Past According to Scientific Creationists

Years Ago	Developments
ca. 3,900	Abraham's journey into Canaan
	Local sequences of degeneracy, migration, cultural recovery
	↖ ↑ ↗
ca. 5,900	Tower of Babel—dispersal of humankind
ca. 6,000	Deluge—only ark survives
ca. 10,000	Rapid appearance of cities, metallurgy, pots, farming, pastoralism
	CREATION WEEK

FIGURE 2

Time of occurrence of important developments in the human past, in a scientific creationist view (based upon Morris, 1984). Since creationists are not unanimous on the date of creation and the timing of gaps (if any) in the account in Genesis, their dating of these events may vary; some place the deluge as much as 1,600 years later than shown here.

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example, which reports that Cain, son of Adam and Eve, built a city. However, all of these achievements were destroyed without a trace some forty-three hundred to six thousand years ago (depending upon the particular estimate) by the Noachian deluge—which is also credited with depositing the entire fossil record and most of the geological column. Only the eight people and the animals saved in the ark survived.

About a century later, according to creationists, God caused the "confusion of tongues" at the Tower of Babel because people had stayed in the Near East, disregarding his command to go forth and fill all the earth. This event led to the dispersal of humanity, as well as the proliferation of human languages. As people spread from the Near East, the hardships of travel, unfamiliar environments, and isolation caused their cultures to degenerate, losing their technical sophistication. Only some time after settlement of a given region did cultural recovery and fresh waves of migrants cause the reappearance of metallurgy, agriculture, and civilization. In this creationist view, the past is marked not by the slow emergence of cultural complexity but by a decline from sophistication to a very imperfect state as a consequence of human sinfulness. Thus, the stratigraphic sequences of stone tools underlying metal ones and villages underlying cities reflect a brief and recent plunge into cultural degeneracy, followed by a recovery from it—rather than a long process of cultural development.

Creationist Treatment of Prehistoric Archeology

The above interpretation, of course, relies primarily upon Genesis, although most biblical scholars contend that such a use of Genesis is incorrect (*see*, for example, Frye, 1983). But how do creationists account for its drastic discrepancies from the picture drawn by archeologists? One could imagine two basic approaches to this problem. First, creationists could do archeological research themselves, finding and interpreting evidence to back up their representation of the past. Second, they could tackle the evidence already accumulated by archeologists, showing how it is better explained by the creationist account than by conventional interpretations.

Regarding the first alternative, it is clear that creationists have done precious little research themselves on archeological problems, even though their claims about the past have testable implications. For example, given the creationist account outlined above, one would expect that sophisticated cultural developments such as cities and metallurgy date back literally to the dawn of time. This leads us to the Genesis flood, to which creationists typically ascribe nearly all the geological and fossil records. Flood geology has been shown to be utterly inadequate to account for the fossil and geological records (*see*, for example, Strahler, 1988:188–243). However, granting for purposes of argument the creationists' geological claims, the question remains: what *archeological* evidence would one expect to find? If

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fossils of all sorts were deposited by the flood, would we not discover amidst flood-laid strata the durable archeological traces of antediluvian cultures, such as the remains of stone and brick cities or artifacts such as pottery? Of course, we do not find such cultural evidence until geologically recent times, but the point is that creationists have neither noted nor tried to test this idea. Interestingly, Henry Morris of the Institute for Creation Research has discussed, and dismissed, the possibility of finding antediluvian human *fossils* (Morris, 1984:421–422) but has not raised the specifically archeological implications of his beliefs. Morris's argument against expecting to find antediluvian human fossils is a classic case of special pleading, based upon the assumption that people fleeing the rising flood waters would have reached the highest peaks before being engulfed and, thus, failed to become incorporated into flood sediments.

Actual archeological research by scientific creationists is extremely rare. The only research program of sorts which could be described as archeological is the search for Noah's ark, inevitably termed *arkeology* by its critics (LaHaye and Morris, 1976. For appraisals, *see* R. Moore, 1983; Stiebing, 1984; Feder, 1990). Creationist arkeology should not be confused with the legitimate scholarly field of biblical archeology. Biblical archeologists use standard archeological and historical methods to study the cultures of biblical lands from the Bronze Age to the period of early Christianity.

Most creationists accept a medieval Armenian tradition which identifies the ark's landing place (Mount Ararat) with the volcano Agri Dag in eastern Turkey. They recount alleged sightings there of remnants of the ark by everyone from local peasants to Russian aviators. The ICR and other creationist groups have mounted repeated expeditions to find the ark. On one of these expeditions, ex-astronaut James Irwin nearly died in an accidental fall; on another, ICR's John Morris was struck by lightning. However, no one has ever presented authenticated photographs, fragments, or other hard evidence of the ark found on Agri Dag or elsewhere. Thus, creationists have almost nothing to show in the way of original archeological research to buttress their account of the human past.

What about the second possible approach—demonstration that existing archeological data are better explained by creationists' reconstruction than by conventional accounts? The most immediate stumbling block to any reconciliation between scientific creationism and conventional archeology is in the time scales of the two accounts. Creationists deal with this problem, as with all claims of an ancient earth, by dismissing the dating methods used by archeologists (as well as geologists and paleontologists; for a rebuttal of their criticisms, *see* Strahler, 1988:129–158). However, creationists sometimes do accept dates supplied by these methods when they are consistent with their beliefs. Thus, Morris says, "Radiocarbon dates for events more recent than 2000 BC may be fairly good, but all earlier dates are invalid due to fallacious assumptions involved in these and other radiometric age calculations" (1984:449). He offers no explanation why radiocarbon

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dating should work for the past four thousand years but not for earlier times.

With the cornerstone of dating thus disposed of, the archeological record becomes an assortment of disparate sites and artifacts from which creationists can pick and choose data to support their case. There still remain relative dating methods, which put events of the past at least in correct temporal order. Chief among these is stratigraphy, based upon the order of accumulation of the strata (levels) of a site. Creationists acknowledge the validity of this method when they agree that sequences of archeological levels with stone, then later bronze, and finally iron tools characterize many regions. They do not, however, examine the archeological record in detail but, rather, select bits and pieces of it as it suits their purpose.

For instance, in a rare creationist treatment of evidence from the Paleolithic or Old Stone Age (roughly that which exceeds ten thousand years in age), Duane Gish (1985:185–200) takes issue with standard interpretations of the Zhoukoudian (or Choukoutien) site, famed as the cave home of the Peking Man fossils. At this site, deep deposits, several hundred thousand years old, have yielded fossils of early humans (the small-brained, large-browed *Homo erectus*), numerous stone tools, evidence of fire, and broken animal bones. Current archeological interpretations of the site vary (Binford and Ho, 1985; Lu Zune, 1985), but all agree that tool-using, meat-eating pre-Pleistocene *Homo erectus* played a role in the accumulation of the deposits.

Gish, of course, demurs. Most of his discussion of Zhoukoudian is an attempt to discredit the fossils as genuine hominids (members of the human family) intermediate between modern people and earlier hominids. Instead, he calls them apes. His line of argument is outside the scope of this article and has been refuted elsewhere (Brace, 1986). However, Gish also makes an archeological claim: he proposes that the artifacts and evidence of fire at the site were produced not by the *Homo erectus* "apes" but by fully modern humans who were their contemporaries. He supports this claim by citing a supposed find at this site of skeletal remains of fully modern people. In doing so, however, he simply discounts the records of the site's excavators—records which clearly show that the modern skeletons from the so-called upper cave were found stratigraphically far above the levels which contained *Homo erectus* and the artifacts in question and are thus much younger. Gish simply asserts that things were not as the excavators described, although he presents no evidence, citing as his only authority an obscure work by a Catholic missionary (O'Connell, 1969) who was in China at the time of the excavations. O'Connell never even visited Zhoukoudian, but Gish approvingly reports his contention (again, presented without evidence) that the site was not a cave after all but a limeworks!

Meanwhile, Gish ignores the recent work at Zhoukoudian by Chinese archeologists which confirms the finds of the original excavations of the 1920s and 1930s, as well as evidence from numerous other sites in China and elsewhere in the Old World that *Homo erectus* indeed made stone tools and butchered animals with them,

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among other activities. In short, Gish's archeological claim is resoundingly at variance with the archeological record.

Creationists typically accept the aspects of standard archeological interpretations which agree with their beliefs and disregard the many other aspects of these same interpretations which contradict them. Morris (1984:444–448), for instance, approvingly and selectively quotes archeologists who state that both agriculture and civilization first emerged in the Near East (the setting of the main events of Genesis). He then claims that the accoutrements of civilization—pottery, metallurgy, animal husbandry, agriculture, and cities—all emerged at about the same time in the Near East, "exactly as the Bible has said all along." He cites a number of archeological studies as supportive of his assertion.

They are not. The same body of research which indicates that agriculture and civilization first emerged in the Near East also shows that agriculture preceded civilization there by several thousand years. Archeological research using the same methods and logic as that cited by Morris furthermore shows that the rise of agriculture in the Near East was preceded by a Paleolithic age hundreds of millennia long; that the world's oldest archeological sites are not in the Near East (as the creationist account requires) but in Africa; that pottery first appeared in Japan rather than the Near East; and that both farming and civilization evolved independently several times in various parts of the world (*see* Wenke, 1984). Thus, the creationist scheme presented in Figure 2 is resoundingly refuted by the known archeological record.

What scientific creationists mainly do in regard to prehistoric archeology is to discard blithely the standard dating of the past (as too old for their purposes) and to ignore vast amounts of accessible archeological findings which are inconsistent with their beliefs.

Thus, they treat the archeological record much as they treat science in general—with misrepresentation, distortion, and, especially, omission. Needless to say, their writings have not swayed archeologists. However, the failure of scientific creationism as scientific discourse is, in important respects, no failure at all. Its proponents are not writing and speaking to convince archeologists of the error of their ways. They are not really speaking to the scientific community at all. They do not conduct conventional scientific research or try to publish their findings in conventional scientific and scholarly journals (Scott and Cole, 1985).

Instead, as Raymond Eve and I have discussed elsewhere (Eve and Harrold, 1990), their efforts are directed not at mainstream scientists (whom they no doubt regard as a lost cause) but at the lay public. More specifically, creationists aim their literature at two audiences. The first consists of millions of conservative Christians who perceive their biblical literalist faith to be threatened by scientific findings that contradict the creation story in Genesis. Creationists reassure these people by telling them that science, widely accepted in our society as a prestigious source of truth, does not contradict Genesis after all; only the false science promulgated by "secular humanist" scientists opposes the Bible.

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The second audience includes those outside the conservative Christian camp who have no direct stake in the creation-evolution issue but who may be persuaded that there is "something to" scientific creationism. Even if they cannot be converted religiously, the members of this "bystander public" (Turner and Killian, 1987) may be convinced on grounds of "fairness" that their states and communities should have "equal time" policies mandating the inclusion of creationism in public school science classes. Such government accommodation of anti-evolutionism is the principal goal of the current creationist movement.

Most Americans are "scientifically illiterate" (Miller, 1987) and have little comprehension of the concepts, methods, and findings of science. There is enough scientific-sounding terminology in scientific creationist literature (much of which is written by men with doctoral degrees of some sort), combined with populist appeals to "common sense" and anti-elitism, to deeply impress people who lack the requisite knowledge and understanding to evaluate it (Nelkin, 1982:165–179; Eve and Harrold, 1990).

In most ways, prehistoric archeology receives characteristic treatment from scientific creationist authors. However, this treatment is generally brief. In most of the standard creationist publications, there is less space devoted to prehistoric archeology than to the other main source of information about early humanity: the human fossil record. For instance, *How to Teach Origins (Without ACLU Interference)* by John N. Moore (1983) devotes only about ten pages of an eighty-one-page chapter entitled "Origin of Humankind" to topics in prehistoric archeology. Gish's *Evolution: The Challenge of the Fossil Record* (1985), whose ninety-two-page chapter "Origin of Man" contains perhaps the most detailed creationist treatment of evidence for the human past, treats prehistoric archeology in three passages totalling less than five pages.

There are exceptions to this generalization. Henry Morris (1984), for example, gives greater prominence to prehistoric archeology. He draws heavily on Arthur Custance (1975a, 1975b), a Canadian anthropologist and specialist in medical physiology, whose rather obscure books deal extensively with archeological topics, though his methods are typically creationist. Custance generally avoids direct confrontation with archeological findings by citing fragments from the literature which seem to support his complicated, Genesis-inspired account of the human past.

Unfortunately, this general creationist inattention to archeology is mirrored in the books by scientists for general readers (Strahler, 1988; Godfrey, 1983). Although they refute creationist claims, they make little mention of archeology while containing considerable discussion of the human fossil record. And the pages of *Creation/Evolution* have featured a number of articles on creationist misrepresentations of the human fossil record (for example, Conrad, 1982, 1986; Wolf and Mellett, 1985; Nickels, 1986; Brace, 1986) but few concentrating on creationist archeological claims (for an exception, *see* Cole, 1985).

Why do creationists say relatively little about prehistoric archeology? If they

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were really concerned with demonstrating the scientific consensus to be invalid, they would have to come to grips with the evidence supplied by archeology, which points to the antiquity of humankind and the slow emergence of cultural complexity, and offer explanations of that evidence which are superior to those currently accepted. However, as we have pointed out, scientific refutation is not their goal.

Influencing lay people *is* their goal. To do so, they pragmatically concentrate on the topics of which the lay public is most aware while downplaying those of which there is less popular consciousness. I believe that this is why prehistoric archeology gets short shrift from scientific creationists; most people in their audience are relatively unaware of it. There is some currency in our culture to terms such as *cave man* and *Stone Age* (though the latter is actually most often applied to extant peoples—for example, "Stone Age Tribe Found in New Guinea"), and many Americans have heard of the archeology of pre-Columbian Indians (though geologically such remains are very recent). But few people are aware that archeology has provided much information, quite independently of the human fossil record, about early humanity.

Almost everyone has heard of the Leakeys, "Lucy" and Neandertal man, and many people have some notion of the significance of these names. Few, though, have heard of correspondingly important terms in prehistoric archeology, such as Francois Bordes, Olorgesailie, Catal Huyuk, or Cahokia. Few know that many fossil localities, like Olduvai Gorge, are even more important for their archeological sites.

I base this suggestion on my experience of teaching students and watching media treatment of these subjects. To test it less impressionistically, I conducted an online computer search for news articles relevant to the two topics in question (the human fossil record and prehistoric archeology) in the BRS National Newspaper Index, which covers five nationally circulated newspapers—the *New York Times, Wall Street Journal, Christian Science Monitor, Washington Post*, and *Los Angeles Times*—from 1979 to the present. I reasoned that the incidence of stories of new developments in these two fields would reflect their relative levels of public awareness and interest. The keywords chosen for each category were intended to select stories specifically associated with each of the two areas. The keywords chosen for the fossil man category were *Australopithecus*, hominid, *Homo erectus*, Neandertal, Leakey, and Johanson; for the archeology category, I used prehistory, prehistoric, arch(a)eology, Paleolithic, and prehistoric arch(a)eology.

The search results met my expectations: seventy-five stories used the fossil man keywords, while only twenty-five used the prehistoric archeology keywords. We can reasonably infer that the public is less aware of prehistoric archeology and the implications of its findings than of the human fossil record. I think that this is why the former topic receives less attention from creationists and their critics.

I suppose that archeologists should be in one sense relieved at being spared the detailed attention of creationists; after all, they must put up with enough nonsense from devotees of "ancient astronauts" and lost continents (Stiebing, 1984;

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Feder, 1989). On the other hand, this lack of attention implies that the general public is largely unaware of what archeologists do. Given archeology's importance for understanding the human past, its practitioners must increase their efforts to communicate with the public. We should have no illusions that more education, formal or informal, will "solve" the creation-evolution controversy (Eve and Harrold, 1987), but greater public awareness of the basis for the scientific picture of the past can at least help reduce the susceptibility of the religiously uncommitted to the blandishments of "scientific" creationism.

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Linguistic Tendencies in Creationist Texts: Hypotheses

Wade Tarzia

Those who present creationist arguments often do so in a traditional way: this is the hypothesis I propose and suggest ways to test. Here I mean *tradition* in the folkloristic sense—a common set of ideas, or *worldview*, communicated through a common set of linguistic techniques.

I want to explore briefly some ways in which folkloristic studies can assist in the understanding of the creationist movement. This is not a Bible-as-folklore paper, as valid as that approach might be: rather, it is an analysis of creationist styles of presentation from the viewpoint of a student of folklore. The behavior

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defining a group of people, such as creationists, is appropriately studied by folklorists; folk traditions are *normative*, seeking to maintain conservative social values, and folklore studies have accrued a large body of knowledge about this process. My guiding viewpoint is that the linguistic folk tradition of creationists creates, maintains, and signals a group tradition through the use of language.

This approach leads to many promising comparative and cross-cultural avenues of analysis; however, here I wish only to suggest a way to begin by outlining some ways to categorize creationist language and by citing some examples from creationist texts. This analysis formulates hypotheses to test in a more thorough project. In this spirit, I will draw my examples in the fashion of a case study, focusing on some pamphlets published between 1988 and 1990 by the Institute for Creation Research, including *Acts & Facts* and its appended pamphlets *Impact* and *Back to Genesis*. Certainly, future research should include a wider sampling of texts, including books, articles from other magazines, conversations, and performances.

There are several definitions of folklore and folk tradition ranging from the most limited, which requires strictly oral performance in small groups (*see* Ben-Amos, 1972:12), to the broad, which includes examples drawn from written texts and which I use here (*see* Limon and Young, 1986, for a review). Narrower definitions may blind us to overlaps, analogs, and distant kinships between various human behaviors, and so I am in the school of the broad definitions and consider printed texts as fit subjects for folklore studies. What does unite textual and oral studies is the concept of the folk group—the idea that a definable group of people use an identifiable tradition of language with its supporting themes and elements. Dundes (1980:6) interprets a folk group as any group that shares at least one common factor, such as occupation or religion.

Bauman (1972:38) discusses how folklore can be used by a folk group, either esoterically (to define the group from within) or exoterically (performed "at" other groups in order to enhance cultural differences); he reminds us that folklore can be "as much an instrument of conflict as a mechanism of contributing to social solidarity." These definitions explain both the traditional speech used in creationist texts (building social cohesion) and the themes in the texts that suggest an embattled group held at bay by outsiders (the mainstream establishment, perceived as antireligious by "insiders").

Alan Dundes introduces the most embracing and useful definition of folk traditions, which I adopt in this paper. He writes:

> The genre divisions often artificially limit research. For example, a scholar may write about themes in mythology or even in a single myth and pay no attention to the occurrence of the identical themes in other genres. [1972:94]

He approaches such a difficulty by defining the *folk idea*. To illustrate the idea, Dundes cites related utterances in American speech expressing materialistic

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philosophy. Such phrases as "money talks," "money isn't everything, but it helps," and "you get what you pay for" are common, traditional expressions, although they are not fixed enough in phrase to qualify as proverbs. "To the extent that such premises or ideas are traditional, I believe they are part of folklore and that they should be studied by folklorists" (1972:95).

The framework of the folk idea permits us to move between various normative linguistic behaviors to gain a larger view. Folklore is not only the behavior of small groups or a strictly oral behavior or a behavior serving entirely to build cohesiveness in society. Instead, folklore is also a linguistic behavior of large groups which share a specific idea, may present ideas for either cohesiveness or division, and can appear as either oral or textual performance.

Folklore Themes

Themes are groupings of ideas, not necessarily of specific words, and their structure can vary in the amount of richness in detail (Foley, 1988:42). For a modern example, picture the protagonist of a novel or film sitting in a bar, where he or she meets someone unexpectedly or someone who has information to impart. This must be a useful theme, because its basic structure is replicated endlessly in American literary and cinematic tradition, even if the details vary. So, too, are many other themes endlessly replicated in folklore and anecdote. "Themes" are successful organizing principles cross-culturally.

In many folk tales we encounter the theme of the isolated hero—one who is vulnerable but able to triumph over many difficulties (Luthi, 1987:128, 135). Isolated heroes are often young (an isolation of age) or socially isolated (a person of low or unusual status) (1987:136); for example, Cinderella, a young orphan, has both attributes. Heroes can be physically isolated from the comfort of their communities as well, such as an exile or a spy. We need not leave our own culture to find the theme of the isolated hero; we need only search through a few television channels or the paperback book rack for James Bond, Philip Marlow, Hester Prynne (*The Scarlet Letter*), or Ishmael (*Moby Dick*).

The lone hero appears also in creationist literature. One example from a news item about California's denial of the ICR's application to run its "graduate school" as a licensed institution demonstrates the rhetoric:

> Having been *forced* into the legal arena after specializing in the *academic* arena for years, ICR and its scientists have become painfully aware of the ruling *humanist "elite"* who seemingly are bent on *complete control of education*. [*Acts & Facts*, 1990c:1; emphasis added]

The same pamphlet gives tribute to a deceased ICR member and participates in

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the language of heroism:

> We will miss "Granny" for her encouragement through her own difficulty, yes, but more than that, for being a prayer warrior who faithfully took us before God's throne and did mighty battle against the powers of darkness. [1990:7]

Obituaries often extoll the virtues of the deceased, highlighting "good works" rather than illuminating failings, but nonreligious obituaries cite accomplishments, not "God's throne" and battles against the "powers of darkness." The appeal of the lone hero fighting against great establishment odds may be a theme characterizing the oral and literary performances of cult movements in general; I have observed similar themes in "cult archeologist" texts. The theme invokes at the same time our sympathies (aren't we all "little people" in certain contexts?) and the confidence imparted by old, proven folk tales, which in the end shows the lone hero triumphing in spite of odds—marrying the prince, slaying the monster, or finding the grail. While lone heroes are deficient creatures—parables of humanity in general (Luthi, 1987:137)—through their travails they gain help from supernatural and unlikely sources, proving that the very structure of the world is on their side. Certainly, this is a powerful theme to invoke by creationists, "witnessing" before a self-defined hostile world.

Another creationist theme concerns the way in which conflicts between hero and foe turn out. This theme often appears in "chronological" events of a verbal conflict between debators. The technique portrays one of the debators as having the "last word" in the argument. The reporter of the event tries to cite examples of arguments in which a clear winner emerges in a dramatic way, silencing foe and spectator alike with the weight of a pronouncement. (The traditional folklore genre of the proverb is designed to do this and is often a key feature in verbal disputes worldwide.) The "winning" of the debate depends more often upon the mental filter of the summaries than upon empirical data. Creationists appear to summarize debates one-sidedly. When live arguments are truly won in front of the public with thunderous (and quotable) pronouncements, such instances are retold with pleasure, becoming part of anecdotal canons. But I suspect that the "last word" is just as often a construct of narrative art, and it appears in demonstrably traditional tales. For example, the "flyting" is a literary theme in early medieval folk narratives: two people engage in ritual verbal dueling, and the winner has the last word in the argument while the loser falls conspicuously silent (Clover, 1980).

In four pamphlets, usually in the context of reporting a debate between an ICR spokesperson and a university scientist, the pro-creationist debator is depicted as having the last word in the debate (*Acts & Facts*, 1988:5, 1990b:3, 1990c:4; *Back to Genesis* 1990b:c). In *Back to Genesis*, the writer recounts asking questions of an opponent; however, the opponent's answer to the last question is *not* recounted,

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and the writer closes the segment with "It was fruitless to continue the conversation, as people can justify anything, using (or misusing) the Bible, if they really want to, by taking verses out of context and applying their own interpretation, etc." If the opponent had a last word, I wonder where it went? Perhaps it was fruitless to include it (1990b:c)? A counter example to this appeared in *Back to Genesis* (1990a:3), where the opponent's rebuttal finishes the item.

Creationist depictions of debate are clear in the ICR pamphlets. The question is: how did the debates end in actuality? Did they indeed end as reported, with the pro-creationist debator having fairly won the position to make closing rebuttals in the majority of the debates? Or were the articles written to depict the creationist as having the traditional last word? If so, I accuse the writer of no falsehood; if only the more positive or flattering aspects of the debates were reported, no lie has been necessarily told, but the creationist writer cannot assume the mantle of neutral objectivity.

I propose that people seldom ever have the last word in a real argument. We must artificially define a cut-off point at which we say, "The argument is done. Now let's tally up the points and declare a winner." The debators might well have continued the argument after the formal session or during a question-and-answer period or at a reception. But folklore performances can be selective, presenting only a portion of a real event and a portion that potentially leads us in a less than objective direction.

One creationist theme that I find particularly interesting may indicate that the power of myth is being invoked when "founding fathers" and national origins are mentioned. For example, *Impact* (1988:ii) includes a discussion of teaching evolution in public schools. Among the arguments is the statement, "Science was developed largely by creationists (Newton, Kepler, Galileo, Boyle, Pascal, Ray, Maxwell, etc.). . . ." This statement may well be true, but it is also formulaic—the formula being a reference back to famous people in order to support a claim, regardless of any extenuating circumstances (for example, that the society of earlier famous men was broadly traditional and offered few socially approved opportunities to diverge from religious tradition). We might call these men *founding fathers* of science whose children (evolutionists?) have strayed from the certified straight and narrow path of their forefathers. This is the creationist theme, but might we not imagine that Darwin would be pleased that his ideas are still current a century after his death? Newton might take greater pleasure could he know that Einstein, among others, used his research as a foundation rather than as an end wall.

We find a second instance in the same article quoted above; the formula is more overt in this case: "The founding fathers of our country and all of our first schools were also creationist in belief." This argument fails as evidence against evolutionist thinking, but the founding-father formula—extended even to their first schools (note the quality of "firstness" in this folk idea)—is a reference back to national origins, one might say *sacred* origins. Thus, the formula may be associated

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with the power of placing mythic validity in the argument against evolution.

Another *Acts & Facts* reports the success of creation seminars: "Many commented that they had never realized before the direct connection between the creation/evolution battle and the future of their family and nation" (1988:1). This is a more attenuated variation of the "mythic origins" theme, invoking family and nation, perhaps linking creationism and fundamental social structure—all related to sacred origins.

The sacred origins of a people are associated with a time of stability—the unspoiled land or "golden age" of which myths so often tell. As Abrahms writes:

> Myths commonly give a framework for discussion of the contradictory elements within both the natural and social realms. To be sure, most myths attempt to provide some sense of reunification in terms of cultural or social balance. But to assume that this balance is any kind of real equilibrium is to ignore the very reason why myths must be recited periodically—because the group senses the presence of a disequilibrating force. [1972:27]

This is a common creationist concern: the erosion of traditional Christian values in modern society and the need to restore them. Functionally, the use of myth performances and some creationist themes are comparable. If it is supportable that founding-father formulas and associations of religion, family, and nation bring to mind sacred origins (ultimately associated with the dominant Christian underpinnings of Western society), then creationist texts may indeed share the function that mythologizing has performed throughout human culture.

Formulaic Utterances

Formulaic utterances are building blocks of tradition. They are tools for rapid and convenient composition, especially during oral communication, during which speakers must "think on their feet." Formulas live up to their name because they are systems or recipes for producing standard kinds of phrases (*see* Fry, 1967, discussing formulas in analogous Old English texts). The study of these building blocks is a sophisticated specialization in studies of epic oral poetry such as *The Iliad* and *Beowulf* (*see* Lord, 1960; Foley, 1981, 1988). However, formulas occur in less structured (at the sentence level) prose folk tales (O'Nolan, 1968), and, indeed, in everyday anecdotes and conversations. "Have a nice day" is one such formula.

Formulas occur in a great variety in human speech, but in all cases they allow modules of speech to come rapidly to the lips (or typewriter) and ease the creation of traditional texts because formulas are themselves capsules of culturally shared philosophy. The observation of formulas in a text is another step toward defining

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Table 1
Bibliographical Compilation of Formulaic Phrases

Acts & Facts, 1988: establishes beyond doubt.

Acts & Facts, 1990a: clearly shows (p. 1); powerful, positive evidence, totally negative, devastatingly contradictive (p. 2; note that *contradict* is a term used in many formulas); very well attended and effective, entirely cordial (p. 5).

Acts & Facts, 1990b: complete control, near total control (p. 1); powerful positive evidence (p. 2).

Acts & Facts, 1990c: strongly contradictory (p. 3).

Back to Genesis, 1990a: strongly evolutionary and pantheistic (p. b); thoroughly convinced, outright fabrications, most subtle and convincing manner, new and ever more subtle attempts (p. d).

Back to Genesis, 1990b: totally disagreed, definitely is incorrect (p. b); total preoccupation (p. d).

Impact, 1988: totally false, arrogantly and offensively demanded, no evidence whatever (p. i); vigorously oppose, assert blandly, completely without evidence (p. ii); utterly discredited (p. iv).

Impact, 1990: tremendous impact, clearly support, utter embarrassment (p. iii); demonstrates beyond any doubt (used twice on p. iv).

the traditional speech of cult groups, such as creationists.

ICR pamphlets reveal examples of apparent formulas in the creationist tradition. I have selected here related phrases that occur more than once. Interestingly, such phrases seem to be more common in news items describing debates between scientists and creationists and in items of sermonistic tone. Items that more directly present basic information, such as upcoming conventions, are devoid of these phrases. Also, items that are, or pretend to be, scientific articles seem devoid of the formulas (these articles use traditional scientific voice—that is, the passive voice). The sources of the phrases, as well as additional phrases occurring only once but in the same tone (one can use them as targets during future searching), are listed in Table 1 (*see also* Table 2).

Note that the formulas are not usually word-for-word copies of each other. Some amount of variation can exist as long as the major concepts are collocated to form a traditional system. Further studies of formulas will enable us to characterize better the building blocks of "cult" language to compare with other cult groups and to general conversational and journalistic styles. This approach can be both taxonomic and semantic, because the phrases themselves are capsules of meaning, signaling dominant strands in a text.

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Table 2
Examples of Formula Systems

Formulas based upon *total:*
totally false; totally negative; totally disagreed; near total control

Formulas based upon *complete:*
completely without evidence; complete control

Formulas based upon *clear:*
clearly shows; clearly supports

Formulas based upon *contradict:*
strongly contradictory; devastingly contradictive

Formulas based upon *evidence:*
no evidence whatever; completely without evidence (also indexed with "completely X" formula above); powerful, positive evidence

Formulas based on *utter:*
utterly discredited; utter embarrassment

I have mentioned a few of the many possible topics that a folkloric approach to creationist texts involves. My research has just begun but already suggests several areas of comparison between creationist texts and folk tradition. Besides development of topics outlined here, the relation between creationist texts and specific genres of folklore should be explored. For instance, the genre of the *legend* is known worldwide and cuts across many areas, even within multifaceted American society. One of the traits of legends is the inclusion of pseudoscience to explain strange events; we might liken this trait to the flawed use of science in some creationist arguments. I also urge comparisons with other cultural movements, such as the "cult archeologists" (*see* Cole, 1980; Harrold and Eve, 1987), whose use of language is in many ways similar to that of creationists. Such comparisons will help us define the general traits of cult language and understand better the forces that move a group of people to define themselves against a mainstream society. Such a study will serve as a microscope—a special kind, one that we can use from either end. Cult groups are certainly not the only groups with traditions; so-called establishment society has its own traditions and folklore and can learn about itself from the people who set themselves apart from or challenge it.

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Dealing with Creationist Rhetoric

Dale F. Beyerstein

"Scientific" creationists have an advantage when they debate a scientist defending evolution. Scientists who remain true to their calling must not only persuade their audience, they must also present the scientific facts fairly according to the canons of scientific discourse. Creationists, on the other hand, labor under no such constraint; they reject much of the scientific method and its associated mode of argument and hence don't have to let that get in the way when they try to persuade an audience.

Scientists must worry about a dilemma when they simplify the scientific facts in order to present them to a lay audience. While they want the facts to be comprehensible to the lay person, not wishing to lose their audience with a number of qualifications which, though important, are difficult for a nonspecialist to grasp, the scientists don't want to simplify the issues to the point that false statements are made. This dilemma provides the creationist with a powerful debating advantage. The creationist knows that his or her dogmatic assertions will appear to the lay audience as straightforward, no-nonsense presentations of the facts; in contrast, the scientific opponent will appear obfuscating and evasive. The lay person is simply not used to people who carefully qualify their remarks. Just about the only context in which the lay person may encounter such careful use of language is when they observe politicians attempting to weasel out of taking a definite stand on an issue; and hence, they become cynical about anyone who presents so many qualifications.

Furthermore, the smartest of the creationists are acquainted sufficiently with the scientific literature to be able to catch up a scientist who presents a simple version of the facts without qualifications. The creationist can point out the technical caveats, thereby making it look like he or she knows more than the scientist or like the scientist is trying to hide something embarrassing to the evolution position. The scientist has no similar maneuver available, since the creationist position is entirely lacking in subtlety. There are no qualifications that need to be

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worried about; thus, the scientist cannot tie the creationist up with such subtleties.

The scientist can, however, point out the blatant contradictions that are readily apparent in the creationist position. But, if the audience cannot see these absurdities on the surface, it will do the scientist no good to dig out more absurdities that lurk deeper.

Frederick Edwords (1982) has made a suggestion that will help with this problem to a certain extent. If the debate is confined to a narrower topic—such as the *evidence from paleontology* for evolution or creation rather than *all the scientific evidence* for evolution or creation—the creationist can be criticized for bringing up irrelevancies. Also, the scientist will then have the opportunity to deal with particular points in more detail. When a proper debate format is used, the issue ought to be "resolved that paleontology provides evidence for creationism," rather than "for evolution," because then the onus of providing proof is on the creationist instead of the scientist. Organizing a debate this way would be an answer to the perennial problem of getting the creationist to state his or her position and preempt any absurd attacks on evolution.

This strategy is not foolproof, however; it doesn't *prevent* the creationist from running all over the map instead of sticking to the issue. It merely means that the creationist will likely lose the debate—not that there is a correlation between the evolution side winning academic debates and creationists changing their minds.

Creationist Misuse of Language

There is a further weapon in the creationists' arsenal which must be dealt with. Creationists specialize in using words in a manner *calculated* to promote misunderstanding and to confuse the issues. And they often manage this so thoroughly that, when a scientist introduces facts into the discussion, they become lost in a morass of nonsense.

Often creationists play upon emotive connotations which are not part of the meaning of a scientific term but which are part of the lay person's understanding of it. A case in point is the term *materialism.* As understood by scientists, it has a technical meaning quite unrelated to its common meaning, which is roughly synonymous to "money-grubbing."

But sometimes it is not an emotive appeal that the creationist is after. Often he or she will simply trade on ambiguities that promote misunderstanding, thus preventing the scientist from getting his or her point across. The scientist faces two difficulties here. First, the more he or she is used to dealing with these technical terms in his or her own field, the less likely he or she is to think of the "ordinary" meanings of these terms and, thus, will not realize how the audience is misinterpreting his or her remarks. This would not, by itself, be a serious problem for the scientist who primarily lectures to undergraduates and may be used to *un-*

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intentional misunderstandings caused by these ambiguities. But the second difficulty arises when a scientist is used to dealing with honest academics who are *trying* to understand a position; he or she is less likely to know how to deal with the charlatan who is purposely trying to promote misunderstanding.

The major mistake often made by scientists when faced with such an opponent is that the scientists think they do not need to deal with this verbal sleight-of-hand directly. Instead, they concentrate on correcting the factual errors made by the creationist, without realizing that the audience is not in a position to see what the error is, and why it is so important, until the conceptual confusions have been resolved. One reason the scientist does not deal directly with the misuse of terms is the wish to not appear pedantic in front of a lay audience. This is an important consideration, but sometimes it is better to risk sounding pedantic than be systematically misunderstood.

In what follows, I shall discuss six of the terms with which creationists most often play fast and loose: *theory, fact, chance, cause, design*, and *purpose*. I will attempt to explain how creationists use these ambiguities to advance their cause. I leave it to the skilled debator to find a way of explaining these points in a manner that will not lose a lay audience.

Theory Versus Fact

Creationists have been so successful at muddying the waters with the terms *theory* and *fact* because both words are ambiguous. Scientists wish to maintain that the theory of evolution is *both* a fact and a theory; but given the ordinary meanings of these terms, it is extraordinarily difficult to clarify this point. The problem arises because in *one* meaning of *theory* and *one* meaning of *fact* these terms are contrasted with each other. But according to the *other* meanings of *theory* and *fact*, these terms can both be applied to the same statement.

Perhaps it is easiest to see how these different senses of the two terms relate to each other if we display them in the form of a table. In the first column of Table 1, I show the two different senses of *theory*, and in the second column, the two different senses of *fact*. The meaning of *fact* which appears beside the term *theory* on each row is the sense in which theory is *contrasted* with fact. Note the words in **boldface** at the beginning of each definition. If we use these terms, we can help eliminate the ambiguity that the creationists have been exploiting.

Now examine the two concepts in row *A*. Scientists claim that the theory of evolution is a **scientific fact** as opposed to a mere **hypothesis.** That is, the theory of evolution has been confirmed to the same degree that any scientific fact has been confirmed. This is not to say that it is impossible for the theory of evolution to be falsified. It is just that is *has not been* to date and, given the evidence in its favor, is unlikely to ever be falsified. At any rate, the arguments propounded to

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Table 1

	Theory	Fact
A	**Hypothesis:** "In a loose or general sense: A hypothesis proposed as an explanation; hence, a mere hypothesis, speculation, or conjecture; an idea or set of ideas about something; an individual view or notion." —*Oxford English Dictionary*	**Scientific fact:** A hypothesis which has been confirmed by so many observations or experiments that the probability of its being false is negligible, and which has a higher probability of being true than any rival hypothesis.
B	**Theory:** "A scheme or system of ideas or statements held as an explanation or account of a group of facts or phenomena; a hypothesis that has been confirmed by observation or experiment, and is propounded or accepted as accounting for known facts on which it depends; a statement of what are held to be the general laws, principles, or causes of something known or observed." —*Oxford English Dictionary*	**Particular fact:** An individual item of information—for example, that a bird's beak is 8 cm long—that is gained primarily from observation; or a generalization that has been gained from several observations—for example, that the average beak length of a particular species of bird is 8.1 cm. A particular fact is usually just what stands in need of explanation by a theory. A particular fact is one *kind* of scientific fact, as opposed to another kind, a theory (in sense *B*).

date by the creationists do not give us any reason to doubt its truth.

On the other hand, scientists rightly insist that the theory of evolution is a **theory** in sense *B*, as opposed to a **particular fact**. It is because it is a theory in sense *B* that the theory of evolution is so important for the teaching of biology—and why the creationist opposition to it constitutes such a threat to the teaching of science. Without the theory of evolution to provide coherence and order to the particular facts of biology, learning biology would have scarcely more value than attempting to memorize the telephone directory. Theories have a special status in science because of their ability to allow us to explain the particular facts of a discipline and because they sometimes aid us in the discovery of new facts. One way of seeing the importance of the theory of evolution to biology is to compare modern biology with its "creation science" alternative; creation science simply lacks any unifying theory. That is precisely why it is so jejune.

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Theory of Evolution Versus Theories About the Mechanisms of Evolution

There is yet another confusion over the concept of theory that the creationist will exploit if given the chance. This confusion results from ignoring the distinction between the theory of evolution *per se* and various theories about the *mechanisms* of evolution. The *Oxford English Dictionary* defines *evolution* as "the origin of species of animals or plants, as conceived by those who attribute it to a process of development from earlier forms, and not to a process of 'special' creation." Of course, the defender of evolution wants to do more than simply cite this definition; the point is to present the evidence for it, and this involves discussion of theories of how evolution might have taken place. But care must be taken to ensure that the discussion does not slide, without the audience being aware of it, from a discussion of evolution *per se* into a straw man caricature of a theory of the mechanisms of evolution. No one in their right mind would defend the latter, but the creationist will try to pass it off as the view of Darwin and the view defended by modern scientists.

As soon as the scientist points out some of the various alternative theories of the mechanisms of evolution—from Lamarck to Lysenko to Darwin to Stephen Jay Gould—the creationist has a new ploy. He or she will attempt to leave the impression that each of these theories of mechanisms are *equally* plausible yet inconsistent with each other, thus "canceling each other out"—that the probability of *any one* of them being true cannot be very high if it is no more probable than any of the alternatives.

The first reply to this gambit is to point out that it is not true that the rival theories of the mechanisms of evolution are equally probable, nor that they are inconsistent with each other in the way the creationist would have the general public believe. Many proposed mechanisms of evolution have been falsified—for example, those of Lamarck and Lysenko. The theories which remain are few in number and incomplete (the latter, a point which proponents of these theories are the first to make). Because they are incomplete, we are not in a position to assert that they are inconsistent with each other. As new evidence forces modification of these theories, the possibility remains that this evidence will render probable some synthesis of rival theories which will prove consistent.

The second reply to the creationists' gambit—and perhaps most important—is to point out that, just because at present we are not in a position to know which theory of the mechanisms of evolution is correct does not mean that the theory of evolution must be rejected. The fact remains that we have a small number of theories of mechanisms which are plausible in their own right and—a point that cannot be overemphasized—far more plausible than the creationist or any other alternative.

One of the advantages of drawing a distinction between these two is that it

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allows the defender of evolution to show why the creationist debating strategy of attempting to argue *for* creationism by arguing *against* particular theories of the mechanisms of evolution is so barren. It assumes that creationism and the particular theory of mechanisms are *contradictories*—that is, that the truth of one entails the falsity of the other, and the falsity of one entails the truth of the other. In reality, they are only *contraries*—that is, they cannot both be true together, but they *could* be false together. Thus, even if the creationist could show that a particular theory of the mechanisms of evolution is false, that would do nothing to demonstrate the truth of creationism. Creationism could be false as well and would be if some other theory of mechanisms which the creationist has not examined is true.

Creationism and the theory of evolution are not contradictories either. They also are contraries. Both could be false if some other creation myth of some other religion were true or if Fred Hoyle is right in thinking that we are the descendants of spacemen or if the *real* scientific creationists who preceded Darwin, who postulated a *series* of creations in order to account for the fossil evidence available at the time, turned out to be right after all. The creationists do not consider all of these other alternatives. They do not even consider the theory of evolution but, rather, a straw man. And even if they were to consider each of these in turn and provided sufficient reason for dismissing them, this would not make creationism any more probable than it is—and they are at the mercy of the next theory that will be devised. Until they are prepared to provide arguments for their own theory, we cannot take them seriously as scientists. Unfortunately, they are such dangerous *pseudo*scientists that we cannot afford to take their efforts lightly.

Chance Versus Cause or Design

Creationists play the same game with *chance, cause*, and *design* that they play with *theory*. Again we find the term *chance* mistakenly opposed to two sets of terms. And if creationists are allowed, like Humpty Dumpty, to use words any way they wish, the argument will fall apart. Of the leading books defending evolution against scientific creationism, Futuyma (1983:132–147, 184) is perhaps most succinct at sorting out the nonsense generated by creationist misuse of these terms.

Chance, as used in discussions of evolution, is an *epistemic* term; that is, it refers to our degree of knowledge about which of several possible outcomes might occur in a given situation. We invoke the concept of chance when we lack sufficient knowledge to provide a causal explanation of which outcome will occur and, thus, are forced to predict the outcome on the basis of probabilities. To say that a given outcome occurred by chance is not to rule out a cause for it; it merely means that we are *not aware* of the correct causal explanation. Nor does it rule out a particular type of causal explanation—one having to do with human (or a god's) design or purpose. You may run into your friend at the supermarket by chance,

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but this does not mean that you or your friend had no purposes that explain your both being there; it simply means that whatever purposes you had did not include meeting the other person. Or if you are unaware that a pair of dice is fixed, you may assume that the chances of them coming up twelve are one in thirty-six, when in fact the dice are designed to display twelve more frequently. Thus, there is no reason to rule out purpose or design when talking about chance.

But let us look at a situation that closely parallels the position scientists are in when they discuss evolution. You meet your friend at the supermarket on purpose, but a third party is not aware of that purpose, although he is aware of some of the other facts which are relevant to explaining your behavior. The information neither rules out nor entails that you have this purpose in mind. Thus, given the information that this person had, he could not predict that you will meet your friend—or that you will not. It would be a mistake for him to claim that the evidence that he does have can settle the question. But this is not to say that he is in a position to deny that you have a purpose or that you will meet your friend. This is the position that a scientist dealing with the scientific information is in with respect to the question of a god's design or purpose behind evolution. The scientific evidence by itself neither entails nor rules out any information about a god's purpose behind evolution. The scientist may have religious beliefs which lead him or her to believe that there is a purpose behind evolution. But it would be a mistake for him or her to claim that the scientific evidence entails his or hers religious speculations.

Assuming that creationists do not succeed in their efforts to destroy science, our knowledge will increase and our reliance upon probabilistic arguments will diminish. However, given our present knowledge, the use of probabilistic arguments provides the creationists with a goldmine of numbers to fiddle with in a scientific manner and bamboozle those who stand in awe of mathematics but do not understand it. The creationists have had the greatest success in this endeavor in arguing that the theory of evolution ought to be rejected because it assigns an absurdly low probability to life forming on earth. Typical of these arguments is Gish (1981) who quotes the information theorist H. J. Morowitz as claiming that the probability of matter arranging itself into a bacterium, without divine intervention, is $10^{(10^{11})}$, or one chance in one followed by one hundred billion zeroes. In the fashion typical of the pseudoscientist, Gish provides us with no information on the background conditions assumed for this calculation.

Aside from calling this calculation into question, we should point out that, even with a few more zeroes tacked on for good measure, this statement by itself does nothing to refute evolution. Three further conditions must hold before this probability estimate can be used to doubt the theory of evolution: first, there must be a rival theory that explains the occurrence of life at least as well as evolution; and second, that theory must entail a higher probability of life occurring than evolution predicts. Creationism fails both these criteria, because it does not explain

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anything at all about the way life *in fact* originated, as opposed to the myriad of other possibilities. It cannot assign a probability to that event or series of events. The third, and most important, condition is that we must have *independent* reasons for thinking that life had a higher probability of originating than the theory of evolution assigns to it. It is simply a fact that some events occur very infrequently; thus, the correct explanation of an infrequent event *should* predict that it will occur infrequently.

Perhaps an analogy might help. The odds of your getting the last hand that you got in bridge, whatever it was, were one in 635,013,559,600. Does that give you reason to reject the hypothesis that the deck was randomly shuffled and instead to accept the hypothesis that the deck was stacked? Not at all. All that follows is that the world's bridge players are likely to wait a long time before seeing that particular hand again. Now, if you happened to get all thirteen spades in your last hand, you would have reason to suspect some skulduggery, but not merely because this hand is so rare. It is, in fact, no more (or less) rare than any other hand. What gives you reason to be suspicious is the independent evidence you have about your fellow players' intentions and their ability to stack the deck. Only if this independent evidence gives you reason to assign a higher probability to the stacked deck hypothesis (rather than the random shuffle hypothesis) do you have reason to prefer the former to the latter. Of course, you do have independent reason to think that your friends would want to surprise you with thirteen spades—but very little reason to think that they would arrange for you to get a perfectly unremarkable hand. It is because of this independent evidence that cheating is a better hypothesis in the one situation than in the other.

The same point applies to the creation-evolution debate: unless the creationist is allowed to beg the question by assuming that God had some special design for the earth to be exactly as it is, the odds against this particular outcome occurring are irrelevant, even if they do give us reason to reflect upon how lucky we are to be here to raise these questions.

But the questions about what would have become of *us* if evolution had taken a different course—whether or not *we* would have been here—are not the province of scientists or even religionists, until they first get the help of philosophers. The first problem that needs to be settled is who, if anyone, answers to the word *we* in that question. If evolution had taken a different path, such that the creatures which resulted from it were radically different from the way we turned out, it is difficult to know to whom the question would refer. As the old response to the man who wishes he had never been born goes: "Ah, but who should be so lucky? Not one man in a thousand!"

Conclusion

This, then, is my analysis of creationist misuse of key terms they bring into the

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debate. Only by a forthright exposure of such rhetorical abuse of language can an audience acquire a clear idea of the real issues and thereby come to better appreciate the contribution of the theory of evolution to our understanding of life.

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A Final Response to Walter Brown

Jim Lippard

In my two previous articles about Walter Brown (1989b, 1990), I pointed out a number of examples of his poor research. In response, he claimed that, in fact, I am the one who has fallen short of accuracy while his own work is virtually errorless (Brown, 1989, 1990). In the process, a large number of different arguments have been brought up and discussed in varying degrees of detail. In this article, I respond to Brown's various charges and attempt to show that his work is anything but free of error.

First, let me thank Brown for his explanatory comments regarding his sending me "one reproduced section" from his book *The Scientific Case for Creation*. However, I don't think the fact that my original comments were based upon only a portion of his book is of any major consequence. My criticisms were of claims Brown has made and, with two exceptions which he classified as "minor," of claims he has not retracted in the most recent edition of his book. Brown's charge that my reliance upon "an outdated edition" of his work was a "general shortcoming"

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(1989a:35–36) is thus without substance.

The "categorization" scheme Brown uses in his book is misleading—as I pointed out before. He stretches what should be two or three categories of evidence into forty-eight. For example, listing twelve alleged sightings of Noah's ark as twelve separate categories is absurd.

Brown objects to Edward Max's argument for common ancestry from pseudogenes, stating, "Max's case is far from complete. He hasn't identified all known pseudogenes nor shown which organisms do and do not have them" (1990:36). But science *never* has *all* the information, and Brown offers no proof that the evidence is so incomplete that the drawing of any conclusions (however tentative) from it is impossible.

Brown also claims that amino acid sequence research contradicts evolution, citing his book (which in turn cites such sources as Michael Denton's *Evolution: A Theory in Crisis* and a science fair project). It is ironic that in the same issue of *Creation/Evolution* in which Brown makes this claim Matthew Landau's article (1990) points out the very mistake that leads Brown to write, "There is not a trace of evidence on the molecular level for the traditional evolutionary series: simple sea life→fish→amphibians→reptiles→mammals."

Brown then argues that genetic information must have been supernaturally designed. He claims that "no natural process has ever been observed to produce a program" and that "natural processes, without exception, destroy information," asking for counterexamples from those who disagree (1990:36–37). I disagree and direct Brown's attention to William Thwaites' article on the subject of design (1983), specifically to his discussion of Barry Hall's experiments with *E. coli* bacteria (1983:16–17; Hall 1982). And for a discussion of thermodynamic and information-theoretical considerations in the evolutionary generation of complexity, I direct Brown's attention to the work of Jeffrey Wicken (1979; 1987) and others.

Brown points to specific examples of design in nature as evidence for a designer, claiming that this is "not just a philosophical argument" (1990:37). He writes:

> My contention—that technologies (such as radar and powered flight) require intelligence and a designer—has its basis in human experience. Lippard's contention—that complex technologies can come from natural processes—has no basis in experience. Which one is more philosophic?

Both claims are equally philosophical. Having a basis in human experience is not sufficient to make something scientific (or philosophical, for that matter). One could, as Brown attempts, provide scientific evidence in support of one or the other of these two contentions, but this is not something Brown does in his book. I also find Brown's disdain for philosophical argument objectionable. Philosophy has an important role to play in the sciences and has been particularly useful in addressing certain questions about evolution (such as the role of fitness in natural selection

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and the nature and applicability of evolutionary explanations).

Brown takes issue with my statement that "an appropriate structure, *whatever its origin*, is capable of producing valid conclusions from correct premises" and accuses me of obfuscation. His argument purports to be a *reductio ad absurdum* of evolution, claiming that, if evolution were true and our brains arose by natural processes, then our thoughts would be invalid. However, our brain structure is capable of valid thoughts, no matter how it happened to come into existence. When Brown asks, "If Lippard thinks that a structure created by random processes can make valid inferences, why doesn't he show us one?" it is apparent that he does not understand the *reductio* nature of his own argument (a popular one among Christian apologists; Brown himself cites C. S. Lewis as a source).

To Brown's request for an example of "a structure created by random processes [that] can make valid inferences," I substitute the word *random* with *natural* or *evolutionary* and answer: people—five billion of them. This answer begs no questions within the context of Brown's argument, since the argument begins by assuming the truth of evolution.

Brown is mistaken when he says, "Lippard acknowledges that the existence of valid human thought opposes the idea of atheistic evolution and could support the existence of God" (1990:38). I did not and do not make any such acknowledgement and I specifically stated that Brown *fails* to make a case against atheism and does not even address the possibility of theistic evolution.

Speed-of-Light Decay

Brown denies a quotation which is attributed to him in the creationist journal, *Ex Nihilo* (1984), yet refuses to ask for a retraction. The same quotation has been traced to Barry Setterfield's 1983 monograph, *The Velocity of Light and the Age of the Universe*, but Brown claims that no such quotation appears there and that my copy must have been "doctored" (1990:40). This alleged doctoring would not change the fact that the quotation appeared in *Ex Nihilo*. Brown is correct that the quotation did not appear in the first printing (August 1983) of Setterfield's monograph, in which the page in question contained an advertisement for *Ex Nihilo*. My copy of the relevant page, however, came from the second printing, dated December 1983. (I have as yet been unsuccessful in finding anyone in the United States with this edition of the monograph.) I am happy to grant Brown's denial of the quote, but this simply casts more doubt on the veracity of Setterfield, who has already been accused of misusing quotations from his fellow creationists (*see* Humphreys, 1988:40–41).

I criticized Brown for presenting the work of Barry Setterfield unskeptically. In response, Brown cites two sequences from his book which begin with the word *if*, claiming that "tentativeness is there." It is interesting that Brown does not quote

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either sentence in full:

> If either Setterfield or Troitskii's reasoning is correct [in explaining red shifts], the standard Big Bang theory will fall (with a big bang).
>
> [Brown 1989c:90]

> If Setterfield is right, these mature, distant galaxies no longer need explaining.
>
> [1989c:91]

Neither sentence casts any doubt on the speed-of-light decay thesis. In fact, what Brown says about Setterfield is that "his results show that *the speed of light has decreased so rapidly that experimental error cannot explain it!*" (1989c:89; emphasis in original). Where is the tentativeness here? From Brown's discussion, one would never realize that debate over this subject continues to rage even in the pages of the *Creation Research Society Quarterly*. Brown cites none of the numerous criticisms of Setterfield.

Setterfield's response itself is inadequate on the subject of radiocarbon dating and on many other points (1989), as has been pointed out by his critics (Aardsma, 1989; R. H. Brown, 1989; Holt, 1989; Humphreys, 1989). Setterfield's response to Aardsma's radiocarbon argument, which I cited and described in my previous article (1990), is answered by Setterfield with the claim that "the solar neutron flux (which produces C-13 in our atmosphere)" was higher in the past (Setterfield, 1989:193). But as Aardsma points out, it is cosmic rays, not "solar neutrons," which are responsible for the production of C-14 (Aardsma, 1989).

Brown also discusses the 1675 Roemer measurements from Setterfield's data (Brown 1990:41), but again does something which he criticizes me for on the very next page of his article: he cites unpublished sources. In fact, what Brown cites are a pair of computer messages from the Usenet newsgroup net.astro from Lewis Mammel. Fortunately, I was able to obtain copies of the messages from Mammel, and Brown is correct that Mammel's recalculation of Goldstein's data shows a value of c 8 percent greater than today. But Mammel does take issue with Brown's statement, "Mammel also identified a second error, which he claims shows that the speed of light was 8 percent greater in 1675 than it is today" (Brown, 1990:41). Instead, Mammel says this should more accurately read: "If Mammel is correct then the best fit to Roemer's data gives a value 8 percent greater" (Mammel, 1990). He also points out that this value is well outside of Setterfield's originally published curves. Goldstein's reanalysis of the Roemer data, on the other hand, gives a result 2.6 percent lower than the 292,000 kilometer-per-second figure that Brown says he used.

Regarding the statistical measurement of c decay, the debate continues in the *Creation Research Society Quarterly* over whether Setterfield's data even show any such trend. And according to Mammel (1990), the weakest points in the thesis are

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conceptual rather than statistical. There are problems in comparing measurements which use different ways of measuring speed and different ways of measuring time when trying to find evidence for "varying constants" (*see* Barrow and Tipler, 1986:238–243). And William Jefferys (1990) responds to several of Brown's claims in greater detail.

Brown denies claiming that the sun is shrinking at a constant rate, although in his book (1989c:19) he writes, "The sun's diameter is shrinking at a rate of about 0.1 percent each century or about five feet per hour! . . . this rapid shrinking has been going on for at least the past 400 years." In his article, he writes, "I feel that the best data supports a slight but significiant shrinkage trend" (1990:46). Which is it? "Rapid" or "slight but significant" shrinking? And where may these "best data" be found? Brown does not say.

Brown argues, on the basis of the solar neutrino problem, that at least two-thirds of the sun's heat is produced by gravitational contraction rather than by hydrogen fusion, and that this supports a shrinkage trend. However, *all* the sun's heat could be produced by a gravitational contraction rate of only 0.02 feet per hour, or 0.007 arc-seconds per century (DeYoung and Rush, 1989:50). The contraction rate Brown argues for is 250 times this rate. To deal with this problem, some have suggested that only a thin outer shell of the sun is shrinking, but, since more recent studies have not found the shrinkage trend Brown claims in his book, this seems rather *ad hoc*.

There are other possible solutions to the solar neutrino problem—such as time variability of neutrino flux, electron neutrinos being transformed into muon or tau neutrinos by some process in the sun, interaction with weakly interacting massive particles (WIMPS), or the Mikheyev-Smirnov-Wolfenstein (MSW) effect—and experiments are testing them (*see* Bahcal et al. 1988; Bahcall, 1989, 1990). Given these other possibilities, the solar neutrino problem is not so compelling a "line of evidence for a shrinking sun" as Brown seems to think. In any case, the sun's alleged shrinkage is not a reliable age indicator.

Jupiter and Saturn's radiation of more heat than they receive from the sun does suggest that they are generating heat from gravitational contraction or from their initial heat. Neither possibility requires that these planets are young—which they aren't. As a recent introductory astronomy text notes, if the conductivity of the metallic hydrogen in Jupiter's interior is low, it "could easily retain its primordial interal energy for billions of years" (Zeilik and Smith, 1987:102). On the other hand, the same text notes that "the excess heat from Saturn is somewhat of a puzzle" (1987:106).

Fossil Evidence

In Brown's original article, he stated that "as of 1986, at least, [Hoyle et al.] were

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making a good case" (Brown, 1989:42), which I took to imply that Brown no longer thinks there is a good case for *Archaeopteryx* being a hoax. But now he comes right out and says that "Hoyle and Wickramasinghe make a good case that the two fossils of *Archaeopteryx* that have clearly visible feathers are forgeries" (1990:47). He clearly rejects the published refutations of the hoax hypothesis when he writes, "The 'anti-hoax' articles Lippard cites either don't address most of these evidences or else contain statements which are shown to be false by Hoyle's photographs" (1990:47). But Brown gives no examples of these "evidences" or "statements." In fact, the scenario involving cement which Brown describes is refuted by Charig et al. (1986), whose microscopic examinations show no evidence of cement. These authors also dispute the claim that only two *Archaeopteryx* fossils (not counting the recently discovered sixth fossil) have feather impressions. While those on one specimen are not clear, the impressions on the other two fossils are much better. This dissolves the force of Brown's objection that "the significance of all the other *Archaeopteryx* fossils may rest upon whether or not the Solnhofen specimen has feathers" (1990:48).

According to Brown, the reason Protoavis has not been accepted as a bird is that "to do so would eliminate their best example of an embarrassingly few possible transitional forms" (1990:48). There are other reasons—and good ones—for its lack of acceptance. The main reason is that Sankar Chatterjee, its discoverer, has yet to publish any descriptions of his find (Padian, 1989).

In response to my citation of a source containing a large bibliography of transitional forms, Brown says that this is "one more example of [Lippard's] claiming that someone has some evidence which [he] cannot discuss" (1990:48). What would Brown have me do? Include the full text of the article? He claimed that transitional forms are scarce or even completely absent from the fossil record, so I provided a reference to contrary evidence.

Brown (1989a:44) and other creationists (for example, Girouard, 1989; Morris, 1989; Taylor, 1989:91; Willis, 1987) have asserted that Donald Johanson has made statements which show that he has been deceiving people about "Lucy's" knee joint. Now in a new argument, Brown says that the vertical scattering of the *Australopithecus afarensis* fragments is somehow problematic. I forwarded a copy of Brown's statements to Donald Johanson, who replied:

> Yes, it is more than reasonable that *afarensis* lived in the Hadar region at various times over a 700,000 year period. A proximal femur fragment of an immature individual was found in 1981 at Maka, above volcanic ash dated at 4 Myr. Stratigraphically, it was immediately above the volcanic ash, which suggests that its age is close to 4 Myr. At another locality in the Middle Awash of Ethiopia, fragments of a frontal bone from a cranium were found at Belohdelia, in a stratum immediately below the volcanic ash dated at 4 Myr. *Australopithecus afarensis* has been identified on the eastern shores of Lake

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> Turkana in deposits which are roughly 3 Myr in age (nearly equivalent to some of the later remains from Hadar) and, of course, the very important 3.5-million-year-old specimens found at Laetoli, in northern Tanzania, just south of Olduvai Gorge. What this tells us is that *afarensis* was a highly successful species, geographically widespread, and spanned the time between 3 and 4 Myr in eastern Africa.
>
> The rapid burial of bones at Hadar, particularly those of the "First Family," are related to a geological catastrophe suggesting, perhaps, a flash flood. Bones are fragmented and scattered because individuals fell into a river or were washed into a river, rapidly transported, broken up, and scattered. These are all products of a depositional process. [Johanson, 1990]

I suggest that Brown's new alleged problem is simply a way of evading an admission of error.

Brown says that I "falsely stated that Carl Baugh 'has consistently refused' to have the handle of his apparently ancient hammer radiocarbon dated." My information was based upon a report that Baugh had refused an offer made by Robert Schadewald to pay for the radiocarbon dating on the condition that the hammer really turned out to be ancient and upon requests from Ronnie Hastings and John Cole, among others. My choice of adverb was a poor one, particularly in light of Baugh's negotiations with R. E. Taylor to date the hammer (which came about, by the way, as a result of Taylor reading my statement about Baugh).

Conclusion

I think this dialogue displays Brown's true colors. Not once has he conceded any points to me, even when he has been glaringly in error (the only possible exception being two "minor" errors which he said he was already aware of). Instead, he has frequently ignored my remarks (as he did with my basic criticism of his categorization scheme, my remarks on his Lamarckian point, his claim that there are few or no transitional fossils, his stance on Neandertal, Peking man, Lucy's knee joint, out-of-order fossils, and Noah's ark) and my counterproposal to his debate challenge. In other cases, he has responded to my criticisms with new arguments that do not address the original issue (as he did with his random thoughts argument and Lucy's knee joint). He has also made mistaken claims about what others have written (for example, when he claims I acknowledge that valid human thought is evidence for the existence of God and when he writes that Charles Oxnard did not say *Ramapithecus* could have been ancestral to humans). I do not believe that I have made any comparable misrepresentations. I find it particularly ironic that Brown accuses me of asserting that evidence exists for a point, citing a reference, and skipping on to the next point, since this accurately describes the format of

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his own book, in which none of his "categories of evidence" are discussed in any detail (with the exception of his "hydroplate theory").

Another habit in which Brown indulges is constant waffling. He will strongly imply that he holds a particular position (for example, that the sun is shrinking at a particular rate; that *Archaeopteryx* is, or isn't, a hoax; that Barry Setterfield's speed-of-light decay model is correct; or that Lucy was not bipedal) and then, when pressed, deny ever having held such a position. The result is that he avoids the trouble of having to defend himself.

I suggest that the reason "leading anti-creationists" are not willing to engage in extensive written debate with Brown is not because of any fear for their careers or reputations but, rather, because of Brown's above-described habits and his own lack of qualifications.

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Editor's Note

When we first planned to publish Jim Lippard's "Examination of the Research of Creationist Walter Brown" in *Creation/Evolution* XXV, we contacted Walter Brown and gave him the opportunity to reply. Furthermore, we accepted Brown's standard of what would constitute a fair word count for his response. As a result, we were able to publish the two sides of the exchange in the same issue. When Lippard wrote a second critique of Brown's research, we again offered Brown the opportunity to respond, and the debate was continued in issue XXVI.

After two installments of this dialogue, we have received many letters to the editor. Some have criticized us for continuing the debate, and all have disputed Brown's arguments. At the conclusion of his last response, Brown himself criticized the debate, suggesting that Lippard was unqualified to challenge him and proposing alternative individuals who he would find more suitable.

As editor of *Creation/Evolution*, I take that to mean that Brown has stepped

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out of this particular ring. Since Lippard has not, however, we have published his final critique. Letters from our readers follow, providing additional comments.

In fairness, we want you to know that Walter Brown maintains a standing offer to debate in print one or more evolutionary scientists who have doctoral degrees in technical fields. Should any such scientists feel that Brown is a qualified opponent, the proposal is that such a debate be long enough to release as a book (Brown knows of a potentially interested publisher). We therefore reprint Brown's proposed "Statement of Agreement" below:

Statement of Agreement

Feburary 10, 1987

1. The two principle debaters are:
   Evolutionist:
   Phone: ( )

   Creationist:
   Dr. Walter T. Brown, Jr.
   5612 N. 20th Place
   Phoenix, AZ 85016
   Phone: (602) 955-7663
2. The intent of this debate is
   (a) to provide a nonconfrontational vehicle for an exchange and interpretation of data on both sides of a heated issue in which little constructive dialogue is occurring.
   (b) to make available to interested readers a clear and unemotional enumeration of the major scientific evidences on both sides of the creation-evolution issue. The disciplines would include: the life sciences, the astronomical sciences, the earth sciences, and the physical sciences.
3. Each debater will present the evidence which he feels supports his model (or theory) of origins and refutes the opposing model of origins. These models will be defined by each side and submitted with this signed agreement. (POSSIBLE EXAMPLES ARE GIVEN BELOW.)
   (a) The Creation Model of Origins:
      (1) Everything in the universe, to include the stars, the solar system, the earth, life, and man, came into existence suddenly—in essentially the complexity we see today.
      (2) The earth has experienced a worldwide flood.
   (b) The Evolution Model of Origins:
      (1) Over billions of years, the universe, the solar system, the earth, and finally life developed from disordered matter through natural processes.
      (2) Mutations and natural selection brought about the development of present living kinds from simple earlier kinds.
      (3) Man descended from a common ancestor with apes.

   Each participant will also include with this signed agreement a 100–200 word

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biographical sketch and a black and white glossy photograph.

4. The debate will consist of *scientific evidence and the logical inferences from that evidence.* Religious or philosophical ideas and beliefs, while possibly correct, *will not* be allowed. The umpire will strike such ideas from the record. Scientific evidence consists of potentially repeatable observations or measurements which are the basis for drawing conclusions on some proposition. Religious and philosophical ideas, on the other hand, are not derived from physical observation or measurement. Each debater will define his terms, organize his evidence, and present his arguments in whatever way he feels will add clarity to his case.
5. The umpire is:

   Phone: ( )

   He has no strong feelings on the creation-evolution issue.
6. The debate will consist of four submissions by each side of up to 20,000 words each. Each figure or graph will be considered the equivalent of 200 words. These submissions will be sent by registered mail at three month intervals to the umpire. They will be postmarked not later than the fourth of the month beginning in _____. After the umpire receives both submissions, he will delete any religious or philosophical ideas and any personal attacks, inform the author of any such deletions, and then mail each debater's paper to his opponent so that both papers arrive on about the same day.
7. The umpire:
   (a) will make whatever rulings are necessary to help accomplish "2" above.
   (b) will resolve any disagreements brought to his attention by either debater.
   (c) will direct debaters as necessary to address the more important unanswered points made by the other debater, to include new issues raised during the last submission.
   (d) will write a preface to the final written debate stating these agreements, whether or not both parties adhered to them, and any other observations that would contribute to "2(b)."
   (e) will terminate the debate if in his opinion one side is not participating adequately in the debate.
   (f) will act as editor and organizer of the final written product.
8. Both debaters will bear their own expenses and share equally in the phone and mailing expenses of the umpire up to $200 each.
9. Outside parties who do contribute ideas, data, or logic to the written product must be referenced. Those who contribute substantially to the debate may become joint participants. However, the lead debater for each side (whose signature appears below) is responsible for integrating all viewpoints on his

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side into one coherent case.

10. References will be cited but will not contribute to the word count. Short statements taken from those references, which capture the thrust of that source, may also be considered part of that reference. This will reduce the need for a reader to look up that reference and will enhance the readability of the final written debate. Also in the interest of readability, footnotes and computations will contribute to the word count but they will be placed at the end of the book.
11. One side may feel that insufficient documentation has been given by his opponent. If the umpire concurs after consulting with each side, the debater who omitted the reference will have what the umpire feels would be a reasonable time to provide the reference.
12. If one debater feels that his opponent has quoted an authority out of context, he will notify both his opponent and the umpire of this in writing. If the umpire concurs and the opponent does not want to modify or qualify his quotation, the umpire can rule that a sufficiently large portion of the quoted material become an appendix to the written debate.
13. From time to time, each debater will have difficulty locating certain technical papers cited by his opponent. Each debater should make these needs known to the umpire who will then direct that each debater supply specific documents to the other. The umpire, after considering the number and costs involved, will use his judgment to balance the burden placed on each debater.
14. Each side will be permitted three extensions of one month each. The debater requesting the extension should notify the umpire and his opponent as soon as possible but not later than the first of the month that the submission is due.
15. If one party withdraws from the debate, as confirmed and explained in writing by the umpire, the other party will have exclusive rights to publish any or all of the partially completed debate.
16. Within one month after the fourth submission has been made, each debater can notify the umpire if he feels new issues were raised in that submission. If the umpire concurs, he may permit that debater to answer those new issues.
17. Each side is encouraged to correct errors in its case when it discovers them. Corrections or deletions of previously made arguments are allowed as long as they do not exceed the word limit. If, however, a correction is suggested by an opponent's rebuttal, that error can only be changed as described below.
18. When the fourth submission has been made and all new issues have been answered, each debater can propose that certain of his arguments be deleted or modified. This "bartering process" between the debaters is intended to aid the reader by eliminating, in balanced fashion, earlier statements which they feel are superfluous, have been effectively rebutted, or are of questionable accuracy.
19. The final form of the written debate should be as clear and readable as possible. Therefore, after the fourth submission, the umpire will direct the debaters to

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assemble into one coherent argument any scattered arguments dealing with a narrow topic. No new ideas can be added. In this way, the opposing arguments can then be most easily compared and studied by readers. The completed written debate will be in the format directed by the umpire and will include, insofar as possible, the evidence and arguments placed side by side and point by point. It will consist of two main parts: (1) the evolutionist case with the creationist rebuttals placed immediately below each argument, and (2) the creationist case with the evolutionist rebuttals placed immediately below each argument. The shorter of the two will be placed first in the final book.

20. After the debate is completed, each debater will have the right to publish the debate or release it for others to disseminate. Printed copies of the debate must contain the entire debate in final form, including the umpire's preface.
21. This agreement can be modified by mutual agreement of the two debaters.

(INITIAL IF APPROPRIATE) Although I disagree with one or more of the above conditions, I am willing to have a ☐ person ☐ panel (choose one) adjudicate the matter. I will abide by this ruling and participate in the written debate. My disagreements and suggested changes are listed below.

Evolutionist Date:	Walter T. Brown, Jr. Creationist Date:	Umpire Date:

Letters to the Editor

Does Dr. Walter Brown deserve any more of our time than he has already absorbed? Alas, he does, because he has achieved some power here in Arizona, enough to influence an Arizona State Board of Education science teaching directive.

A "science essential skills" committee was formed to define: (1) science skills students should acquire in school; (2) the nature of the students' mastery of those skills; and (3) classroom indicators that would show this mastery. Dr. Brown was appointed to

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this committee by a minion of our famous impeached former Governor Mecham.

I was told that Dr. Brown was a rather low-key member of the committee—not the fire and brimstone type. Nevertheless, mention of organic evolution is conspicuously absent from the science essential skills document. On the other hand, "Piltdown hoax" is there as are the phrases "overly authoritarian" and "so-called scientific statements."

Most indicative of his influence is the following. A student demonstrates that he "understands the patterns by which major scientific ideas change" if he "traces discoveries that have led and continue to lead to the conclusion that life is more complex than was previously believed." When I first read this, I thought it was a back-handed reference to evolution, but I now recognize it as one of Dr. Brown's key principles without its final phrase, "and therefore *must* have been Designed by a supernatural Creator!" . . .

Treating Dr. Brown's fringe science in the same manner as we are obligated to deal with conventional science, as Lippard and Jeffries have done (*Creation/Evolution* XXVI), gives him a legitimacy he does not deserve. In fact, Dr. Brown's "Second Response to Lippard" shines with the light of the classic crackpot. But even Velikovsky didn't put together a list of fifty scientists who were ignoring him and thus "ought to be ashamed." Dr. Brown rejects the procedural rules of the science game ("What good would citations do?") and then blows it off entirely by routinely invoking a capital "C" Creator, capital "D" Designer, and an "intelligent, supernatural source" to explain everything.

Yet, it is unfair to dismiss Dr. Brown as a crackpot. His espousal of "creation science" is driven by the same zeal that has for centuries driven missionaries into far corners of the world to convert the heathen. I believe he was put on the science skills committee because he is an evangelist with a Ph.D. . . .

The Walter Brown situation is a classic case of the biblical fundamentalists winning the skirmishes even though they have been unable to win the battles. In the conflict between science and religious zealotry, the zealots prevail because they understand the rules of the game and we seem *determined* to never learn them! This is a political fight, the rules of logic don't apply here.

Daniel J. Lynch, Ph.D.

The recent exchanges between Walter Brown and Jim Lippard bring less than fond memories of my first encounter with Brown almost a decade ago when Brown's "Scientific Case for Creation" only had 103 categories of evidence (and was distributed anonymously). After learning in the first four categories that spontaneous generation has never been observed, that Mendel's laws of inheritance explained genetic variation and there is a limited amount of genetic variation, that acquired characteristics cannot be inherited, and that

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natural selection cannot produce new genes—and that somehow Brown held these as evidence that the theory of evolution was invalid—I certainly felt that his scholarship and knowledge of biology could be called into question.

Brown's growing list of categories still represents nothing but a quagmire into which the unwary might wander and be unable to extricate themselves. Judging by Brown's responses to Lippard, his tactics have changed little, and there is no reason to expect that Brown will answer or respond directly to questions any time in the future. He will continue to avoid, evade, obfuscate, and challenge "anti-creationists" (a decade ago we were still biologists) to engage him in an extensive written debate. Brown's efforts to force such a debate led him to write to our university [Illinois State University] and imply that if our president did not insist that this untenured, assistant professor comply with his debate demands that future National Science Foundation funding at our institution might be threatened.

However, the most interesting exchange took place between a professor of social history and Brown in a teacher's workshop on the creation-evolution controversy. After Brown verbally made a similar challenge to the one that appears on page fifty-three of *Creation/Evolution* XXVI, my colleague asked Brown, "What does a debate, written or verbal, prove?" Three times Brown ignored the question and continued speaking. My colleague interrupted and said, "I know why you are not answering my question, and I'll have to answer it for you. A debate proves who is the best debater; it never proves anything in science. So, why do you continue to insist on a debate? Because that is the only forum in which you can hope to win." Brown knew then, knows now, and actually is correct when he says you have "everything to lose and nothing to gain by engaging in . . . debate." Like other creationists, Brown does not operate under the rules of science, because in that forum they have lost. Brown was later offered an opportunity to speak on campus at a philosophy colloquium, but refused since it would not be a debate.

If anything, an exchange with Brown reminds me of Br'er Rabbit and the Tar Baby. Lippard tries hard to pin Brown down, but if he ever scores a clear hit, he may find it hard to get free.

Joseph E. Armstrong, Ph.D.

It was flattering to be referred to as "unqualified or incompetent" and not honest, all within (the religious magic number) seven lines by Walter Brown (*Creation/Evolution* XXV:36). Reminds me of the preacher who wrote in the margin of a sermon, "Point weak here—pound fist and shout like hell!"

Correspondence in my possession confirms the time schedule described in my paper. I was originally asked to address a "Faculty/Student Christian Forum," a setting more appropriate for angelic halos than polonium ones. I had one week to research the anti-evolution snippets gleaned for years by

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Brown. In spite of time limitations, I was told, "You debated him as well as a reputable scientist can."

Fred Parrish

Editor's note: Contrary to Brown's critique of Parrish in Creation/Evolution *XXV, he lists Parrish in issue XXVI among the fifty persons he feels are especially qualified to debate him. Figure that one out!*

Walter Brown's rebuttal article was not very convincing (issue XXV). First, while it sounds impressive to present 120 categories of evidence, all you get is a brief outline. Virtually all the categories feature invalid or irrelevant arguments, and over half have factual errors. More than half the references cited are obsolete or nonprofessional works—some out of date by over fifty years. Brown needs to present fully thought out arguments with up-to-date data.

Similarly, giving all theories a fair hearing sounds like a good idea, but science already does this. The idea of fairness does not require that time be wasted continually refuting obsolete or silly theories. Three centuries ago the creation theories of Thomas Burnet, William Whiston, and the like, were good scientific theories, but, by the middle of the nineteenth century, new evidence had rendered them untenable. Today's creation hypotheses do not correct these defects; they simply rehash the already refuted views using current terminology. Evolution theories are unambiguously superior to creation theories in all of Brown's 120 categories. Creationists need to work on original theories—theories with more explanatory power and fewer ad hoc assumptions. . . .

Brown's reply to criticisms of alleged ark sightings is a major disappointment. It is a complete evasion. He not only presents no factual evidence but says it is a waste of time to try to convince someone who doesn't already agree with him: "Giving such information to a skeptic accomplishes nothing." Is this the sort of statement you expect from someone who is honestly seeking the truth with an open mind?

Because Brown steadfastly refuses to supply details of his speed-of-light decay analysis, specific criticism of the work is impossible. However, there are several general criticisms which would cover any analysis Brown may have made.

Any finite data set can be fit to an arbitrarily high precision; therefore, to avoid spurious results, both the choice of model and the estimation technique must be theoretically justified. In this case, neither physical nor statistical theory justifies the use of nonlinear statistical models. Numerically, a quadratic or simple exponential curve is the most complex required to fit the data. Statistically, neither of these is significantly better than a constant.

Nonlinear models are notoriously sensitive to failures of theoretical assumptions. In this case, the problems include a small data set, systematically biased and dependent errors, overweighted early observations, and the

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like. Even if an unbiased, independent, properly weighted data set could be chosen from the raw data, the small sample would provide an estimator with unknown properties. The asymptotic statistical theory would still not apply. The most that could be concluded is that the results are less significant than the asymptotic test indicates, probably much less given the small amount of data.

Brown also makes a number of false assertions on the topic of intelligent design versus random natural processes. At one point, he claims that information does not arise spontaneously in isolated systems, that natural processes always destroy information, and that only an outside intelligence could increase information in an isolated system. He also claims that these observations provide a basis for showing that macroevolution could not occur and a Big Bang could not have preceded life. Further on he asserts that everything in evolution ultimately derives from chance but that chance alone could never produce valid thought.

Every assertion is wrong. Isolated systems receive no outside input at all—by definition. The action of the second law of thermodynamics tends to disorder isolated systems, which increases their information content (more information is needed to describe a disordered system than an ordered one). Natural processes transform information. Demonstrations based upon false premises are worthless.

Can valid thought be the result of chance? It would be hard to conclude otherwise. Many, if not most, thoughts are not valid, and many, if not most, valid thoughts are not true. Historically, trial and error has been the main source of human learning—both of the facts themselves and of the methods for accumulating facts. In artificial intelligence research, scientists have been forced to the conclusion that a chance element is necessary to mimic the flexibility and power of human thinking.

Thought is by no means pure chance; the chance element is crucial primarily in novel situations when creativity is required. Brown's assertion to the contrary, like most creationist arguments, is an example of the empirical result mentioned above: that many thoughts are not valid.

Brent A. Becker

At least one student per semester asks me whether or not it's true that humans use only a small fraction of their mental abilities. I have always replied that this statement is simply a myth made up by teachers to get them to try harder, because in my twenty years as a neuroscientist I had never seen it claimed in a scholarly journal until Walter Brown put it forward as an argument against evolution (*Creation/Evolution* XXVI:39). I would be grateful if Dr. Brown, or anyone else, would provide me with references to the "authorities on the mind" who have made such a statement as a scientific claim supported by data.

C. Leon Harris, Ph.D.

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A couple of points in Walter Brown's response to Jim Lippard (*Creation/Evolution* XXV) reveal themselves as flawed when closely examined. Brown elaborated on them apparently because he was miffed that Lippard had dismissed them as being "philosophical rather than scientific."

Brown considered that he was arguing *inductively* from the complexities of organic systems—that is, "all evidence." Two faults in this line of reasoning are: first, that there must be independent evidence that the systems had been designed, such as a set of plans existing prior to the coming into existence of those systems. A house can be shown to be designed from a set of plans approved by the local building department prior to the construction. That a plan of something can be made *after* its coming into being is no indication that a plan existed before.

Brown's reasoning, also, is possible only within a culture familiar with designing. All of the hours and pages that have been devoted to the "design" argument witness only to the fact that we live in a culture in which we consciously engage in designing and constructing from designs. There have been and are cultures in which such discussion would make no sense at all. A trend in modern art and painting not long ago explicitly avoided "design" in this sense.

Of all of Brown's 1986 statements, his "all evidence points to a Designer" shows his cultural ethnocentricity.

The "philosophical category" Brown admits to contains a change of meaning of a term in mid-thought. "If life is ultimately the result of random chance," he argues, and leaving out the middle premise that "human thought is part of life," he arrives at the premise for the next step: "then so is thought [a result of random chance]." Here, he moved the meaning of the word *life* from "low level" organic functioning to "highly organized" human function without the blink of an eye.

His argument continues quite illogically, extending the idea of life originating from a "random chance" occurrence into a "long series of accidents," something no evolutionist would ever consider. Since "your thoughts" are the result of that "long series of accidents," they "would have no validity." The logic of this has no validity. There is no connection at all between the validity of thought and its possible origin by "accident"!

Brown's style of thought is one that does not involve very careful consideration of all of the steps necessary to reach valid conclusions. He has not examined very closely the assumptions underlying his premises, and he leaves out necessary steps between his premises and conclusions, often violating rules of deduction. This is in regard to just two of his points. How do the others stand up?

Kenneth H. Bonnell

Walter T. Brown, Jr., has recently (*Creation/Evolution* XXVI) criticized an article of mine published several years ago in this journal (XIX).

In my original article, I pointed

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out that increasingly detailed knowledge of the DNA of humans and other primates had revealed a number of instances of shared pseudogenes—the same nonfunctional genetic "errors" in the DNA of humans and apes—which provide strong evidence that these species shared a common ancestor, consistent with the evolutionary model. This conclusion was explained using an analogy from the world of copyright law: an author claiming that his work has been plagiarized can prove his case if he can show that errors in his work have been duplicated in the alleged copy. Shared errors imply copying rather than independent creation; the genetic errors (pseudogenes) that we share with apes imply that these DNA sequences have been copied from a pseudogene in the DNA of a common ancestor.

I will deal individually with each of Brown's four criticisms.

First, Brown states that I failed to consider a second criterion that must be demonstrated in order to prove copying—namely, that "both sets of errors did not have a common cause, such as an adverse event or some agent." Brown's criterion makes no sense to me; I don't understand what "adverse event" or "agent" he is thinking of. In any case, he does not explain how consideration of his proposed second criterion leads to an alternative explanation for shared pseudogenes or how that explanation supports the creation model over evolution. Therefore, his criticism seems to have little bearing on the fundamental conclusion of my article.

Second, Brown says of me: "He hasn't identified all known pseudogenes, nor shown which organisms do and do not have them. Until he has done so, we cannot compare that data with the macroevolution hypothesis." Scientists rarely have all the data they would like in order to evaluate competing hypotheses; if we were forced to wait until all the data were in before drawing any conclusions, science would advance extremely and unnecessarily slowly. Brown seems unaware of the research program that would be required to identify all the pseudogenes in human DNA. Pseudogenes are quite common. Many genes have more than one pseudogene copy; some have more than a dozen. It will be a long time before all pseudogenes are known, but Brown has not shown why we cannot use the ones currently recognized to draw the conclusions discussed in my article. If the creationists cannot explain away the examples of shared pseudogenes currently known, then it is unlikely that they will do better when more examples are available. In any case, as I pointed out in my article, even a *single* example of a shared error makes a strong case for a common ancestor.

Third, Brown states that, "Since most evolutionists believe that humans are more closely related to chimpanzees than gorillas, Max will have trouble selling his argument even to evolutionists." Brown seems to believe that my argument depends upon proving that humans are more closely related to gorillas than to chimpanzees. It does not. Moreover, the notion of shared

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pseudogenes as reflecting derivation from a common ancestor does not have to be *sold*, as it is accepted among essentially all scientists who have considered pseudogenes. But since the relationship between humans, chimpanzees, and gorillas has raised questions previously (*see* Letters to the Editor, *Creation/Evolution* XX), and since there is some new information on this issue, I would like to elaborate on this point.

In my article, I described two types of human pseudogene related to the immunoglobulin epsilon gene. One, the "classical pseudogene," looks like a copy of the functional gene which has suffered a large deletion that removed about one-half of the genetic information. At the time I was writing my article, the evidence suggested that a similar pseudogene existed at the same position in gorilla DNA but not in chimpanzee (Ueda et al., 1985, *Proceedings of the National Academy of Sciences* 82:3712). As was pointed out in the original report of these findings, as well as in my article and the letter to the editor which followed (*Creation/Evolution* XXI), this difference between chimpanzee and gorilla could in theory reflect a closer relationship of humans to gorillas than to chimpanzees, although most other evidence suggested a closer relationship to chimpanzees. Alternatively, as I pointed out, the DNA corresponding to this sequence may have been completely deleted in the chimpanzee lineage. Recent evidence from the laboratory of T. Honjo indicates that this is exactly what happened (Ueda et al., 1988, *Journal of Molecular Evolution* 27:77). Cloning and DNA sequence analysis of this region of chimpanzee DNA reveals a deletion of all four of the major coding blocks of the epsilon gene. What is left includes a portion of the epsilon "isotype switch region" on one side of the deletion and the "epsilon membrane exons" on the other side (although the latter was not demonstrated explicitly by sequence analysis); these are all that remain to mark the position where a complete epsilon sequence once existed. However, the most significant (and surprising) conclusion of the new sequence data is that, because the exact boundaries of the deletions in all three species are different, the deletions probably occurred independently in the three lineages, perhaps as a result of convergent evolution in response to selective pressure to eliminate the epsilon sequence. Thus, the existence of remnant epsilon coding blocks in human and gorilla DNA but not in chimpanzee DNA has no bearing on the question of which two species are most closely related to each other. Furthermore, these epsilon-related sequences do not provide a clear example of a shared pseudogene inherited from a common ancestral pseudogene, since the last common ancestor of the three species may have had an intact functional epsilon copy at this position. However, even without this particular example, other examples support the general argument from shared classical pseudogenes which I described in my article, and indeed since that article several more examples that make the

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point have been characterized by DNA sequence analysis (for example, Miyamoto et al., 1987, *Science* 238:369).

The other type of epsilon pseudogene discussed in my article is the "processed pseudogene." This type of pseudogene is believed to arise when an RNA copy of a gene gets "reverse transcribed" into DNA and the resulting DNA fragment gets inserted back into the cell's DNA at some random position. The processed epsilon pseudogenes of humans, chimpanzees, gorillas, and orangutans have now been cloned and sequenced (Ueda et al., 1989, *Journal of Molecular Biology* 205:85). The data indicate that all four are located at the same position in the DNA. Moreover, if one assumes that greater sequence discrepancy between two species implies an earlier species divergence time, then the sequences of these processed pseudogenes suggest that humans diverged earlier from the orangutan lineage, next from the gorilla lineage, and most recently from the chimpanzees. This is the order of events deduced from much other evolutionary data. These new data are all consistent with the notion that the processed epsilon pseudogene arose in a common ancestor of humans and apes. Other similar examples of shared processed pseudogenes are now in the literature (for example, Lewis and Cowan, 1986, *Journal of Molecular Biology* 187:623).

Parenthetically, I would like to mention that since my article appeared I have observed that questions about the human-chimpanzee-gorilla relationship and about the different types of pseudogenes have deflected readers' attention from the central concept of the article. I chose to write about the epsilon pseudogenes because I had found them in my own laboratory research; if I had a chance to rewrite the article, I would use instead examples of shared retroposons as a conceptually simpler way of illustrating the point of shared genetic errors (*see* Bonner et al., 1982, *Proceedings of the National Academy of Sciences* 79:4709; Mariani-Costantini et al., 1989, *Journal of Virology* 63:4982). Most people are familiar with the idea that viruses can be "caught," and with increasing awareness of the AIDS retrovirus, many have heard that viral sequences can be inserted into cellular DNA. Therefore, it is a relatively small step to learn that certain retroviruses appear at the same position in our DNA as in the DNA of other primates, and that the conclusion that the retrovirus was inserted in the DNA of a common ancestor is straightforward. This kind of example also sidesteps the creationist rejoinder that some processed pseudogenes could be functional (the rare case in which a processed gene inserted near a regulatory sequence which allows its expression).

And, finally, Brown asks the familiar creationist question: "How then did the immense amount of coded, genetic information arise? In our experience, codes are produced only by intelligence, not natural processes or chance." If Brown limits his acceptance of science to only what is "in our experience" or what "has ever been observed" directly, he would

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eliminate most areas of modern science including nuclear physics, quantum mechanics, astronomy, genetics, and the like. All of these involve indirect deduction of abstract principles from what is directly observable. Life on earth is thought to have originated billions of years ago and may have increased in complexity over millions of years before it resembled anything we would recognize as alive today. All this occurred under conditions that are presently unknown but almost certainly different from what currently exists on earth. Therefore, it makes little sense to dismiss the evolutionary hypothesis of a natural—that is, non-supernatural—origin of biological complexity on the grounds that such processes are not something "in our experience." Who could expect to have personal experience of the first millions of years of earth's history?

The genetic information encoded in our DNA may be *like* a computer program in some respects, but Brown begs the question in arguing that it is *sufficiently* similar that we must postulate an intelligent creator of genetic information just because computer programs have intelligent creators. Similarly, it is ridiculous to argue that, because modern "codes" such as Morse code and Braille were designed by intelligent creators, the genetic "code" must also have been. Isn't Brown able to grasp that just because two things share *some* features they don't necessarily share *all* features?

How did genetic information arise? Clearly, we don't know the details, and we may never know. But we can make reasoned hypotheses about parts of the process based upon observations from current molecular biology, population genetics, paleontology, geology, information theory, and so forth; and some of these hypotheses can be tested by experiments, by computer simulations, or by the collection of independent data. Readers interested in these hypotheses might enjoy Richard Dawkins's *The Blind Watchmaker* or Christopher Wills's *The Wisdom of the Genes.*

In summary, none of Brown's criticisms weaken in any way the force of the shared pseudogene argument for evolution discussed in my article. In the years since I wrote it, additional examples of shared pseudogenes and retroposons have been described, all of which put the argument on even sounder footing.

Edward E. Max, M.D., Ph.D.

I would like to comment on Walter Brown's article in *Creation/Evolution* XXV. First, it's interesting that, while "special creationists" usually come from Protestant Christian backgrounds and are obviously trying to win converts, they refuse to discuss religion. The reason is simple: only about 10 percent of their arguments support the book of Genesis. I've tacitly pointed this out to the main group of "special creationists" in the Seattle area and received only hard looks for my trouble. The easiest answer for *any* mystery of origins is to say that "whatever happened, God did it." Since there *are*

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mysteries of origins, those who have decided to believe in a creator *of some sort* can always find justification for their belief.

Not to ask the creationist just what kind of creation is being touted is to fall into the hands of those who argue that mystery equals creation. We should realize that modern creationism is an ad hoc hypothesis that can scarcely lose in a scientifically and biblically illiterate audience. It basically has nothing to do with the book of Genesis.

Next, I would question Brown's statement that "most scientific dating techniques indicate that the earth, the solar system, and the universe are young." Most creationist "age-dating" methods deal with features or misapplied knowledge of such things as geomagnetic decay. . . .

Brown shows his concern for Setterfield's explanation of how starlight from sources billions of light years distant is already visible here, in a universe which creationists suppose is only a few thousand years old.

Suppose Setterfield were correct—that the speed of light six thousand years ago *was* millions of times faster than it is now—what would we expect to see?

There are many mechanical events recorded in starlight, including the rotation of stars, explosions, binary star orbits, and so forth. If these were recorded in light traveling at x speed, and those same streams of light are now arriving here at a speed of x/1,000,000, the events would appear to take a million times longer than similar events recorded in light which didn't change its speed—that is, recent events occurring nearby.

We see no such phenomena; therefore, Setterfield's hypothesis is immediately disproven. But let's hammer in a few more nails.

Brown would like to believe that radioactive decay was millions of times greater in the past, in order to explain away the immense ages indicated for early life forms. He forgets that natural radioactivity would be millions of times *stronger* in that scheme, and nothing could survive.

Those nuclear furnaces we call "stars" would have all exploded.

If the local radiation didn't kill all life on earth, that radiation and heat from the sun (miraculously kept from exploding) surely would be lethal.

Referring to the orbits of celestial bodies and the rotation of stars, we might imagine that they orbited or rotated millions of times faster than they do now, so that their slowed images appear normal (by coincidence, Brown proposes that idea for atoms as they "vibrate." Setterfield uses the same idea to explain the lack of immense "red shift").

In order to get an orbital speed a million times faster, the two objects need to be brought many thousands of times closer together, increasing the effects of solar radiation and heat and driving away the atmosphere. Then you'd have such tidal effects that no structural integrity could be maintained in a planet's crust. . . .

Alternately, you might suggest that present orbits are unchanged from the past but that higher orbital speeds were

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achieved by having a higher level of gravity. Then you would have to suggest that Adam and Eve were happy to look like pancakes, living at immense atmospheric pressures.

You would also have to find a mechanism to slow the motions of orbiting bodies to keep them from flying away as the force of gravity eased.

Brown is right about *apparent* superluminal velocities of matter ejected from quasars. Many other seeming paradoxes are found in quasar studies. All of them vanish if we postulate that quasar "clocks" are running at reduced rates. The resulting "red shift" would be indistinguishable from doppler. Halton Arp compiled a large catalog of quasars with tendrils appearing to lead to galaxies which are much closer than the quasars. If the quasars are at the same distance as the galaxies, all the paradoxes vanish. . . .

Brown successfully points out that we don't know what kind of two- to twenty-celled life forms might have existed to bridge the gap between protoctists and more complex metazoans. By their fossilized burrows, we know that increasingly complex worms existed in the pre-Cambrian, but we have no remains of the worms themselves. I'm waiting to see whether or not any creationist will claim that the shortage of pre-Cambrian fossils does anything for the book of Genesis.

Brown makes this same error as he points out that *Archaeopteryx* came along later than some other birds. Just what kind of creation scenario Brown is espousing I can't guess. It's not Genesis, which has all the birds and sea creatures created on the same day. It's hard to "lose" when one isn't specific about a miracle worker's identity or methods. . . .

Neil Slater

Since most consequential reasoning moves to or stems from basic premises, I do not understand why so many scientists want to debate creationists before they get answers to the following questions: what are the creationist theories? What are the postulates, basic premises, of each theory? What are examples of lines of reasoning that illustrate support, explanation, and prediction in each theory? And what are the range of applicability and limitations of each theory?

I have tried several times to get answers to the first two questions from different creationists. They usually reply but do not directly answer my questions.

Ralph W. Lewis, Ph.D.

It is wonderful to be found wrong in something. When an honest person discovers error in his or her thinking, he or she can only be happy that it was discovered and that some cumbersome baggage may then be discarded. Discredited hypotheses in mainstream science are unceremoniously thrown on the trash heap of tried-and-failed ideas. Progress in science comes through discovery and correction of error, and there are great incentives to find mis-

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takes. It could easily be said that the goal of science is the search to root out error more than it is the search for truth. In this way, progress is automatically truth-converging. When there are fakes and frauds, there is every reason and effort to excise them from the scientific body in order to contain the infection.

Contrast this when error is discovered in the closet of committed believers. The reaction is vastly different. For them, it is not just a simple matter of expunging the wrongs. Error is a disaster, a crisis, hence the powerful disincentive to pry. It is a crack in the dike. Fakes and frauds are hidden for fear of casting doubt on the body. Screwball notions from anyone—trained or not—can flash into prominence if there is the least hint that the idea might give support to the party line. Critical evaluation from within is suppressed or simply nonexistent.

Such are the dangers of absolute truth—it must be flawless. Acknowledgement of even the tiniest scratch bodes evil for the whole edifice. The most miniscule mistake is far more than losing face; it could mean the loss of identity. Consequently, every form of protectionism emerges, most notably denial and cognitive dissonance, all the way to complete withdrawal.

We have in issue XXV of *Creation/Evolution* a classic example in Norman Geisler. The cognitive dissonance flows, even erupts, from the very print on the page. McIver exposed a clear, unequivocal error (I rather believe the error was deliberate, given the litany of other creationist examples of shameless tinkering, but that requires proof), but do we get an equally clear, unequivocal retraction? Of course not. We get, instead, a "probably not authentic." Worse, . . . Geisler prepares us for round two of this circus when he and his cohorts will use McIver's revelation to turn and kick us in the behind. Look carefully: Geisler cites Wendell Bird's *Yale Law Review* article as the source for the false quotation and then says, astonishingly, "So much for trusting the Ivy League publications!" Wendell Bird's derelict scholarship is not to be questioned. *Yale*'s credibility is suspect. Yale's cancer metastasizes at light speed and immediately consumes Brown, Columbia, Cornell, Princeton, Dartmouth, and Harvard so that we can no longer trust any of their communications, either. Alums, pull your card to save yourselves. Say, didn't Stephen Jay Gould have something to do with Harvard? Since we already know Harvard to be a den of humanist snakes, this is only further confirmation that we cannot give any credence to what comes out of there.

The cognitive dissonance and denial continue as Geisler shows us that even though the quote "probably" is not correct, Darrow did, after all, use the word *bigotry*. Therefore, it is not without good reason that he *might* have said such a thing or possibly intimated as much. The same irresponsible behavior was evident in the creationist's response to the marvelous work of Glen Kuban et al. at Paluxy River. Creationists are still mucking around in the mire trying to find Fred

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Flintstone's tracks alongside those of his pets. There has been no clear, unequivocal renunciation of Baugh's slapstick farce in spite of the staring, knock-down evidence that demands it.

It is all well and good to be courteous to those with whom we disagree and to deal with issues rather than personalities, but somewhere there must be a limit to what we must endure. We have witnessed, for example, the "debate" in the pages of *Creation/Evolution* starring Norman Geisler offering the "argument from design." It was good sport to behold the contortions and gyrations of this man swimming in the barrel as Edwords and company pulled off a few pistol rounds in the water. But I—and I'm sure most readers of *Creation/Evolution*—have been through the folly of the teleological, ontological, and cosmological arguments in a freshman logic class. The argument from design has so many fatal flaws coiled about it like a venom-fanged viper that only the notoriously ignorant or the terminally obtuse continue with it. (That it is a false argument does not, of course, say anything one way or the other about the existence of a god or gods. It just may not be used to advance one a single step in the direction of acceptance of a supernatural designer.) . . .

Kent Harker

Announcing a Possible New Debate

The Second Law of Thermodynamics

On June 27, 1989, a public debate took place in Vienna, Virginia, between Dr. Edward E. Max and Dr. Duane T. Gish. During this exchange, Max expressed the view that Gish's argument on the second law of thermodynamics is pseudoscientific because it has been consistently stated vaguely (without defining boundaries or specifying the numerical basis for anything). Max then challenged Gish to, in a reasonable period of time, come up with a specific scientific analysis suitable for evaluation by trained experts in thermodynamics. In written form, this challenge was distributed to the audience and is reproduced below. Gish verbally agreed to accept the challenge and, in response to a letter dated July 12, 1989, from *Creation/Evolution*, agreed in writing as well. The text of Dr. Gish's August 28, 1989, letter

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of acceptance immediately follows the text of Dr. Max's challenge.

With the conclusion in *Creation/Evolution* of the rather wide-ranging and somewhat heated Brown-Lippard debate, space is now available for a more focused and calm discussion of the second law of thermodynamics. There is no requirement that Gish author his paper alone and no necessity that papers on both sides be paired together in each issue of the journal. Although the original deadline date of October 30, 1989, has passed, the challenge still stands, and *Creation/Evolution* remains ready to commence the discussion whenever Gish's paper arrives.

A Challenge to the Creationists

Two conflicting views of "creation science" have been expressed:

1. Creationists believe that their "creation science" arguments against the theory of evolution deserve to be taken seriously as critical challenges to the validity of evolution. They have claimed that their views cannot receive a fair hearing through the normal route of publication in scientific journals because their submitted manuscripts would be rejected for publication by biased journal referees.
2. Evolutionary scientists tend to view "creation science" as *pseudo*science—that is, an attempt to bolster invalid arguments by the inappropriate use of scientific terminology and scientific-sounding arguments. In this view, pseudoscientific arguments succeed in debates before lay audiences only because these audiences are not well enough trained in science to see through a false argument when it is phrased with impressive scientific terms that they don't fully understand.

We would like to propose a challenge to help establish which of these two views of "creation science" is most accurate by focusing on a particular example of a creationist argument that many scientists believe is pure pseudoscience: the argument that the evolution model cannot be correct because it violates the second law of thermodynamics. Thermodynamic principles *can* clearly be used to assess specific models in a valid scientific manner; for example, the feasibility of the extraction of energy from the differential temperatures of ocean water can be determined by using appropriate numerical estimates of temperature, heat capacity, properties of the heat exchanger, and so forth, in calculations based upon the equations of thermodynamics. Is the creationist second law of thermodynamics argument based upon such a valid thermodynamics analysis, or is it simply a debating ploy that is effective with audiences who are not trained in thermodynamics and are easily snowed by scientific terminology?

We now challenge Dr. Duane Gish to demonstrate, if he can, that the creationists' second law of thermodynamics argument is not pseudoscience by publishing the full scientific details of his analysis of the thermodynamics of evolution in a

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rigorous manner suitable for readers who are working scientists specializing in thermodynamics. Gish need not worry that biased journal referees will refuse to publish his analysis because at our request Frederick Edwords, editor of *Creation/Evolution*, has agreed to provide a forum for Gish. This challenge and a creationist response of up to ten typewritten, double-spaced pages (limited exclusively to a technical analysis of the evolution model in light of thermodynamics) will be published if received before October 30, 1989. If no response is received, then this challenge will be published alone, and readers will be left to draw their own conclusions as to whether the creationist thermodynamics argument is science or pseudoscience.

Creationists should be eager to respond if their second law claims are not simply a hollow pseudoscientific debating ploy and if they are sincere in their desire to advance their arguments outside the parochial readership of creationist-sponsored publications. Perhaps this challenge and the creationist response will be a step toward converting an often acrimonious battleground into a substantive exchange of ideas. If—as sometimes happens when mathematicians are forced to write out the technical details of what seemed to be a quite obvious proof—the creationists find that their second law argument against evolution cannot be rigorously and quantitatively supported, and if they therefore decline to respond to this challenge, we hope that they will demonstrate some intellectual honesty and refrain from using this argument in future debates.

Edward E. Max

Gish Accepts

I am pleased to respond to your letter of July 12, and accept the challenge to author an article explaining the creationist interpretation of evolution and the second law of thermodynamics. I do ask you not to set a definite date for a reply. As you know, I have an extremely busy schedule and to agree to a definite deadline for this article would be rather foolish on my part, especially if I were to secure the cooperation of one or more other creation scientists. You may publish the challenge in your journal with the indication that I do plan to answer the challenge and that this challenge will be published in a subsequent issue. I trust that these arrangements will be satisfactory.

I have great confidence in our case here, since I have read books by evolutionists on this subject and know that they have certainly not come up with an answer that the problem the second law poses for the theory of evolution. The old ploy of open systems and an outside energy supply is certainly not the answer to this challenge.

Duane T. Gish

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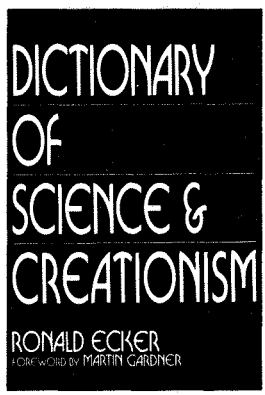

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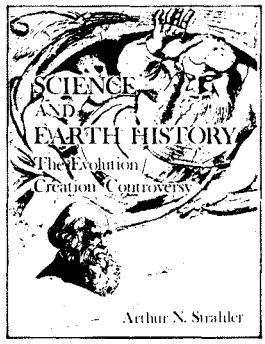

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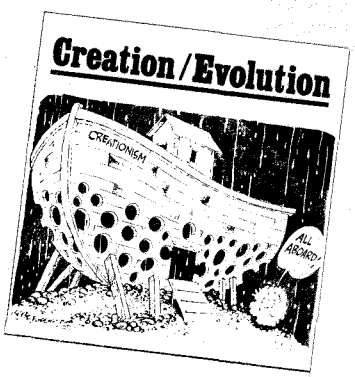

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